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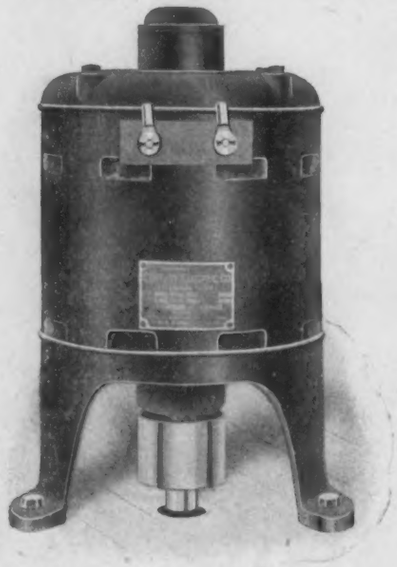

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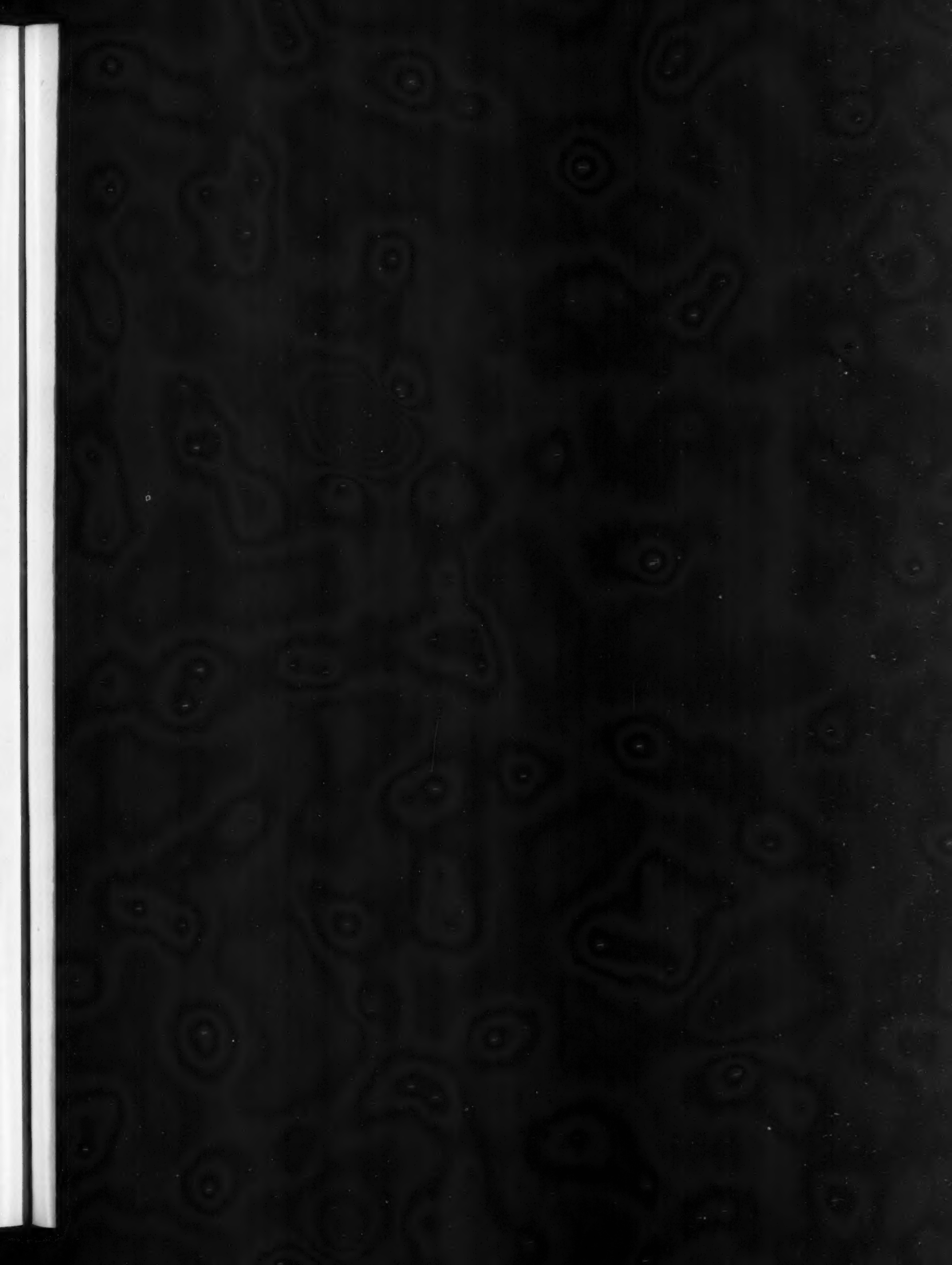

THE

# Journal of Electricity, Power and Gas

WITH WHICH IS INCORPORATED

The Engineers', Architects' and Builders' News

VOLUME XIX. SAN FRANCISCO, CAL., SEPTEMBER 28, 1907 No. 13

## Pacific Coast Gas Association

## President's Address

By John Martin

During the past twelve months many changes have taken place. Probably the most important to the gas fraternity occurred eleven months ago today, when the Ohio, American and Western Gas Associations were indissolubly united at Chicago under the name of the "American Gas Institute." Several members of the Pacific Coast Gas Association were in attendance, and one member was honored by being placed on its directorate. From a perusal of its proceedings, the members of all Gas Associations will derive much profitable information.

One of the most important papers read at that meeting was written by our worthy Past President, Mr. E. C. Jones, entitled, "The Effects of High Pressure upon Illuminating Gas"; the subject matter was entirely original, and, I believe, will prove to be the foundation of much greater research and determination by the engineers of the United States and Europe, and the results which will be obtained will undoubtedly mark a new era in the science of gas manufacture and distribution.

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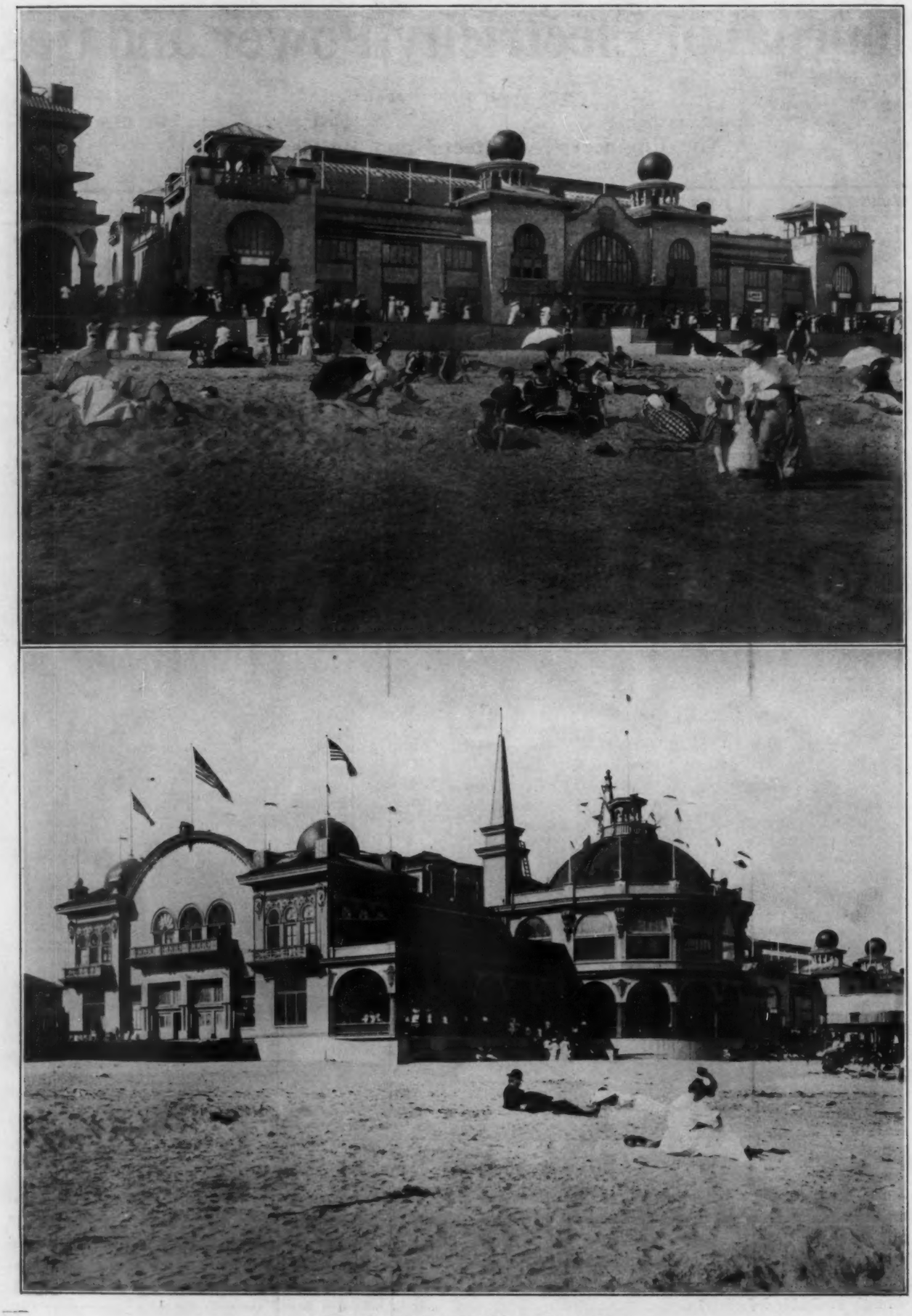
It is indeed a proud moment for us to appreciate that



CASINO AND BATHING PAVILION AT SANT CRUZ

one of the members of the Pacific Coast Gas Association has again pioneered and blazed the way for his successors.

The fact that territorial associations contributed valuable papers to the initial meeting of the American Gas Institute was fully appreciated, and full credit was given. It is evident that this national organization is "persona grata" to the fraternity at large.

The existence of this national institution should spur on the members of the Pacific Coast Gas Association to greater and nobler achievements. Let us vie with one another in a desire to solve the problems which have confronted us so that our burdens may be lightened.

I know that every member of this Association will join me in extending our best wishes to the American Gas Institute and for its success.

Another very great and important change affecting all gas companies on the Pacific Coast, and probably elsewhere, has been the very marked increase in the cost of materials and labor necessary for gas manufacture, distribution and construction. This applies to the electrical fraternity with equal force. In our own territory a very large advance has been made in the price of crude oil within recent months, which will affect all companies seriously. This commodity furnishes the basis of manufacture for more than eight-tenths of the artificial gas manufactured on the Pacific Coast.

When you consider that the general policy of all gas and electric companies for many years past has been to try and reduce the cost of manufacture and distribution, so that the public should obtain more of their product for a dollar than heretofore, without financial loss to the company; and, furthermore, that the efforts of the managers of these companies have been successful in making these reductions annually and biennially, it now becomes a serious question how to meet the exigencies of the present situation. The policy heretofore outlined of constantly reducing prices was permissible as long as the cost price of material and labor did not advance more rapidly than the reduction in cost of manufacture and distribution, resulting from increased output and increased consumption per meter.

From government statistics it may be observed that the purchasing value of a dollar has been materially reduced during the past few years. All food stuffs, clothing, supplies, rents, in fact, everything that we need and use, except gas and electricity, command higher prices than ever before known; and why should the gas man or electric man be prohibited from obtaining the full measure of profit demanded and obtained by the merchant and the artisan? The only answer to this question lies possibly in the fact that the directors and managers of gas and electric companies throughout the United States, and particularly on the Pacific Coast, have made every strenuous effort to reduce their costs of manufacture and distribution in order to try and meet or approximate the demands of a prejudiced public, who have been incited to demand unreasonable conditions from quasi public corporations; conditions which could not be obtained from any other channel of trade, or which would not be conceded by the public as individuals in their particular line of business or vocation. In consequence, the labor costs have been increasing constantly, so that now the gas maker receives more than twice the pay per hour than he obtained ten years ago. This advance is not confined to the gas maker, but is equally applicable to all employees, from the man in the ditch to the highest grade of skilled labor.

In addition to this burden, the cost of the necessary requisites for plant operation and for plant construction and extension has likewise increased in value throughout, demanding a larger amount of money from the companies for a given capacity output.

It is doubtful whether any member of this Association has been more earnest in his endeavors to reduce the selling price of gas and electricity in this territory than the writer, or who has urged more active canvassing for business in order to more nearly approach the point of saturation in the respective communities; thereby having a minimum cost for labor and material and a maximum output per meter; and yet I now feel that there is a limit beyond which it will be impossible for the various gas and electric companies to keep down their costs, owing to the constantly increasing value of material and labor, increasing in a greater and more rapid ratio than the reductions obtainable due to enlarged output.

When the time arrives it will be necessary for the management of the various companies to place their cases fairly and squarely before the people, so that they may appreciate and understand not only the necessities of that particular time, but also to fully appreciate the efforts which have constantly been made in the past to assist every householder in the economic utilization of gas by reduction in price and by proper education in its economical use.

It is becoming more and more apparent to the enlightened citizen in every community that the operation of public utilities is proving expensive and burdensome when undertaken by municipalities. Every competitive feature is removed and every incentive for decreased costs is eliminated, and it becomes a matter of importance only to the politician, in being able to retain his favorites in their positions.

It has also proven true that when municipalities control public utilities there is a constant clamoring for investment of additional moneys in order to serve every portion of their territory with such utilities. These extensions and increases in plant are not economically considered or executed, and if all demands are met with, the burdens of taxation are materially increased.

A disinterested investigation of the material facts with relation to the operation of public utilities by municipalities, particularly in the line of the manufacture and distribution of gas and electricity, will more than bear out statements herein made.

It is not a new subject, but one which has been thoroughly investigated by some of the brightest minds in this country and in Europe, and it is generally conceded that there is no hope at this time for the economical operation of municipal plants with the political conditions now prevailing in the United States.

Another very marked advance in the utilization of artificial gas for power purposes has been the complete and satisfactory demonstration and utilization of the large gas engines of the California Gas and Electric Corporation.

The location of this plant, known as the Martin Station, is well known to you all, and a visit will prove profoundly interesting.

The engines, now in operation, are three in number; all of uniform size, and each producing hourly and daily a maximum of 3,200 kilowatts per hour for periods ranging from 10 to 24 hours as required. The full capacity of each of these engines will be 4,000 kilowatts per hour, when the necessary changes are made in the weight of fly wheel and the nicer adjustments, which had to be worked out in this pioneer plant. The daily logs will be most interesting to you, as they chronicle the operative success more fully and

more satisfactorily than words of mine can properly express.

One of the most inspiring features of the plant is to see a large mass lying cold and inactive, when, with the opening of a valve, it assumes life, and within 60 seconds thereafter is generating a full load and supplying service to the patrons of the company.

When the installation of these engines was first conceived, the primary object was to have a prime generator that would, from cold and rest, become active immediately for the purpose of guaranteeing continuous service for street railway operation. By reason of certain conditions, it was found advisable to operate these engines in parallel with the water power plants, and much concern was felt at the possible success of such parallel operation. Since January, 1907, these engines have been, from day to day, operated without any difficulty in parallel with all of the power plants for the corporation, and should their usefulness, in connection with street railways, ever be impaired by any reason, they would still be valuable adjuncts as auxiliary plants for the entire system.

This was the principal feature which initially prompted the installation of these engines.

I regret that we have no paper at this meeting, on the operation and efficiency of this plant, although data was being compiled for that purpose. The recording instruments used were found to be in error, and the time element necessary for a correct report of the economies of this plant prevented the presentation of this much-desired paper.

I know that the officers of the California Gas and Electric Corporation will see that at our next annual meeting a paper will be presented, giving all facts for the benefit of the gas fraternity.

In concluding the remarks on this subject, it might be well to state, in a general way, that the operation of the gas engines is no less efficient than the operation of high grade condensing triple expansion engines.

While no exact data is obtainable at the present time regarding efficiencies, exact from a technical engineering standpoint, the actual consumption of gas and the rated output of the generators has been practically determined, which gives a certainty to the above statement, and when the engines are able to develop full capacity, and when it will not be necessary to manufacture a quality of gas for general distribution to operate the engines with, much higher efficiencies may be looked for, and I confidently predict that when that time arrives, the actual efficiency of the gas engines from an economical standpoint will far exceed that of the high grade condensing triple expansion engines.

The many and varied uses to which gas has been applied in the last three years, notably in metallurgical and other manufacturing directions, indicate the point of the necessity for the education of engineers through a collegiate course on a broader scale than the mere practical experience now obtained by most of the superintendents in charge of plants in a proper direction of this very extensive use of our commodity.

During our proceedings we are to be favored with a number of very valuable papers which will command your attention, and I wish to request of all the members that they enter into the full spirit of this meeting in every way and join actively in the discussions of the subjects which will come before you. We are to have a paper under the title of "Recent High Pressure Installation," by Past President E. C. Jones. We have all had more or less trouble with sulphur in our oils, and you will undoubtedly be delighted to hear from Mr. P. W. Prutzman on that subject. Our active member, Mr. Geo. S. Colquhoun, favors us with a paper on "Repairing the Cup of a Two-Lift, 500,000 Ft. Gas Holder." Mr. Stephen A. Byrne knows that he has something of interest under the subject of "Practical Suggestions from a Practical Man." I know that you will be pleased to listen to a paper by our worthy Past President and Secretary, Mr. John A. Britton, on the subject of "History of Hydro-Electric and Gas Development in Central California." No member is better qualified to enlighten you on this subject. A very interesting paper will be read by Mr. L. H. Newbert, "Comparative Economy in Operation of Small Motors by Gas, Gasoline, and Electricity." This is an ever-present problem for the managers in all the companies, and this paper should elicit a very full and free discussion. Mr. George C. Holberton submits an interesting paper entitled "One Year After." Mr. Holberton is always interesting, and many valuable suggestions will be obtained. We have a number of topics which have general and local interest, as well as the ever-present "Wrinkles," so ably edited by Mr. Geo. S. Colquhoun, and "Experiences," which have been so thoroughly exploited by the editor, Mr. R. P. Valentine, and the "Novelties" will be shown by Mr. George H. Hollidge.

It becomes my sad duty to report the death of one of our oldest members, not only of the Pacific Coast Gas Association, but one of the oldest men identified with the gas business on the Pacific Coast. I refer to Mr. William G. Barrett, whom we have all loved, and whose absence we deeply deplore. He was one of our charter members, as well as an honorary member of our Association; always kind, loving and cheerful in his associations with the gas fraternity. We cannot help looking backward to the time when we knew him in active life. His genial countenance and his strong personality was a great power for good with all of our members and those who came in contact with him.

For more than forty years he was associated with the one large company which supplied San Francisco with gas, and later with gas and electricity. His whole heart was practically wrapped up in the gas department, not only his whole heart, but even his worthy son was dedicated to the gas business, so that when he laid down his official burdens and was elected Secretary emeritus of the San Francisco Gas and Electric Co., in 1902, Mr. Chas. L. Barrett succeeded his father to the same position.

His death occurred on August 8, 1907, having lived to the ripe old age of more than eighty-four years. He was born in Chester, Vermont, on December 12, 1822.

The funeral services were held on Sunday, August 11th, and the Pacific Coast Association was represented among the pallbearers at the funeral, and a floral tribute in the form of the badge of the Association accompained his remains to the grave.

He was a man to whom we could always go for counsel and advice, and he was ever ready and willing to aid and assist the members of the gas fraternity in every way.

I recommend that a committee be appointed to draft suitable resolutions, have same engrossed upon the minutes of this Association, and a copy engrossed and sent to the members of the family of our deceased member and frater.

In conclusion, I wish to thank all of the members of the Pacific Coast Gas Association for their loyalty and zeal, and bespeak for my successor a continuance of that good fellowship which has marked our career ever since the first gathering in the old office of the San Francisco Gas Light Co. on First Street, in July, 1893.

## A RECENT HIGH PRESSURE INSTALLATION.*

By E. C. Jones, Member Am. Soc. M. E.

The rapid growth of the suburbs of San Francisco toward the South, presents an alluring field for high pressure gas distribution. San Francisco is situated on the end of a peninsula, bounded on the North by the Bay of San Francisco and the Pacific Ocean, on the East by the Bay of San Francisco, on the West by the Pacific Ocean, and on the South by a chain of beautiful suburban towns, extending as far as San Jose, 50 miles away.

These towns are protected from the winds and fogs, which tend to make San Francisco an unpleasant dwelling place, and the climatic conditions are such that as we go south from the city, we enter a veritable garden spot, with semi-tropical vegetation and every attraction to the suburban resident, including excellent railroad facilities, both steam and electric.

In the early days of gas lighting on the Coast, there was a small coal gas works at San Mateo, twenty-one miles from San Francisco, and later an oil gas plant was built at Redwood City. After the usefulness of high-pressure systems had been demonstrated, a high-pressure line, consisting of 2½-inch extra heavy pipe, with line pipe sockets, was laid from Redwood City to San Mateo, 8.2 miles. On this pipe, a pressure of from 10 to 30 pounds is maintained, depending upon the demand for gas. This line feeds into a high-pressure district in San Mateo, which includes 63,490 feet of 1-inch and 2-inch pipe. The consumers in this town are served with gas through high-pressure regulators at the inlet of each meter. This permitted the shutting down and dismantling of the San Mateo gas works.

A high-pressure system was also installed at Redwood City, consisting of 5,410 feet of steel pipe, in small sizes. This is used in conjunction with a low-pressure system at Redwood City, fed from the gas works by one governor, reducing the pressure to four inches of water.

The work of compressing the oil gas at Redwood City was performed by a steam-driven compressor with suitable governors for regulating the high pressure of San Mateo, and the high and low-pressure mains of Redwood City.

During the early part of 1905, Palo Alto, a city of 4,500 inhabitants, five miles south of Redwood City, was piped for gas with small high-pressure mains, and using individual governors. This work was done by the Palo Alto Gas Company. This new company purchased its supply of gas from the Redwood City plant. To supply this district, a 3-inch outside diameter steel tubing, 26,365 feet in length, was laid in the county road, and four storage tanks 29 feet 6 inches in length by 4 feet 6 inches in diameter were installed at the Palo Alto end of the line. This installation was completed May 11th, 1905.

In casting about for a suitable place to locate the storage tanks at Palo Alto, it occurred to the writer that it was not necessary to purchase or rent real estate for the purpose of placing gas-storage tanks above ground, as many gas companies all over the world are occupying the streets with gas mains of greater diameter than these storage tanks. The tanks were, therefore, placed under ground in a tandem sequence, closely surrounded by earth, while the regulators occupy spaces between the tanks, in neat boxes with covers flush with the surface of the ground. This arrangement is both safe, inoffensive and economical. This high-pressure line is operated under pressure varying from 40 to 60 pounds, and to ensure continuous service, it became necessary to install an electrically-operated compressor at the Redwood City plant, retaining a gas-engine-driven compressor as a reserve.

*Paper read before Fifteenth Annual Convention of the Pacific Coast Gas Association.

To improve the service, and to permit of better regulation, a storage tank was installed at the Redwood City works, and into this tank all the gas used by Redwood City, San Mateo and Palo Alto, was pumped. The gas was liberated through separate governors, giving to each of the three places the required pressure. At that time the affect of compression on candlepower was being widely discussed, and was but little understood. All that was known was that the illuminating value of the gas suffered almost directly proportionally to the increase in pressure.

It was evident that the raising of the pressure to 60 pounds on the Palo Alto line reduced the candlepower 4.6 candles. The compression liquid, depending in quantity on thermal conditions and the amount of pressure, was being drawn out of the drips on the line. This liquid consisted of water, naphthalene, and a high grade of benzol. This benzol represented the cream of the candlepower of the gas, and consisted of the least staple and most sensitive hydro-carbons, which were squeezed out of the gas by compression.

The writer inferred that the compressed gas at 60 pounds pressure was nearly free from water, and was therefore in the best condition to readily and quickly take back into itself the hydro-carbons which had been squeezed out of it; also that the hydro-carbons would more readily be taken up and again enter into the composition of the gas than the water would be, because the benzol evaporates so much more readily than does water.

The physical changes in the gas, due to compression, and to the restoration of the candlepower, are in the following sequence: The compressor squeezes out the water and some of the hydro-carbons, and, in order to replace the hydo-carbons, it becomes necessary to keep the gas in intimate contact with the fluid resulting from compression. To do this, the writer designed an extremely simple piece of apparatus, and gave it the name of auto-enricher. It is a simple cylinder, preferably of large size, into which all of the compressed gas and the fluid of compression as they come from the compressor enter at one end, at the top, and the gas is taken out at the other end, at the top, care being taken that the passage of the gas is slow, and that none of the liquid is allowed to escape from the auto-enricher, except as it is taken up by the gas. Such a re-enriching tank was placed under ground at the Redwood City plant, with the result that the candlepower at San Mateo, Redwood City and Palo Alto was restored to its original condition before compression.

Further experiments (which were subsequently made the subject of a paper by the writer, read before the American Gas Institute) proved that by raising the compression, certain physical changes took place in the gas, until, at 300 pounds pressure, the gas was completely purified from sulphuretted hydrogen and naphthalene, these going down with the compression fluid and not reappearing in the gas when the benzol is taken up by the gas in the re-enriching tank.

In 1905, the largest oil-gas plant in the world was designed and constructed on new lines, at a point on the Bay of San Francisco, in San Mateo County, in close proximity to the San Francisco border line, and was named for our President, Martin Station. This plant was built for the purpose of supplying gas to a number of large gas engines, for directly generating electricity. Before the completion of these engines, the gas-generating plant was finished and started.

To utilize this enormous plant, a 12-inch steel tubing was run along the county roads into San Francisco, and connected with the works of the San Francisco Gas & Electric Company, at the Potrero Station. The length of this line is 4½ miles, and a steam-driven compressor was used for transferring the gas. This proved so satisfactory

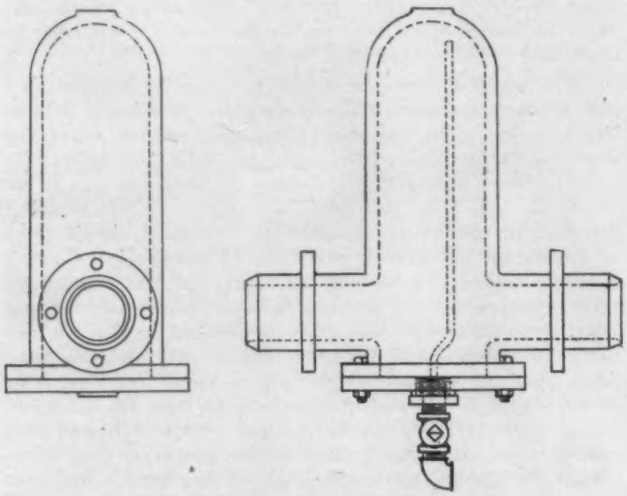
that it became the nucleus of the largest compression plant for manufactured gas in existence. Two power-driven compressors were installed, each having a capacity of 5,500,000 cubic feet of gas in twenty-four hours.

Following the growth of this plant, the gas engines, three in number, each 5,333 horsepower, were completed and successfully started.

Between Martin Station and the south is the high ridge of the San Bruno Mountains, but west from Martin Station, there is a gap through the range, which permits of a practically level outlet into the county roads leading from San Francisco down the peninsula to the south. It required the earthquake, which is not yet effaced from our memory, to bring out the fact that Martin Station is a desirable point from which to supply gas to the cities and towns of the peninsula through high-pressure mains.

The peninsula towns were directly in the path of the earthquake's greatest destruction, but as the high-pressure mains and nearly all the distributing mains in this section were of wrought iron, not the slightest damage was done to the distributing system. This is true of all the high-pressure systems in California. No wrought iron pipe was broken, and no joints were disturbed.

The Redwood City gas works, however, did not fare so well. The boiler settings were badly damaged, and the



DRIP BOX ON HIGH PRESSURE LINE

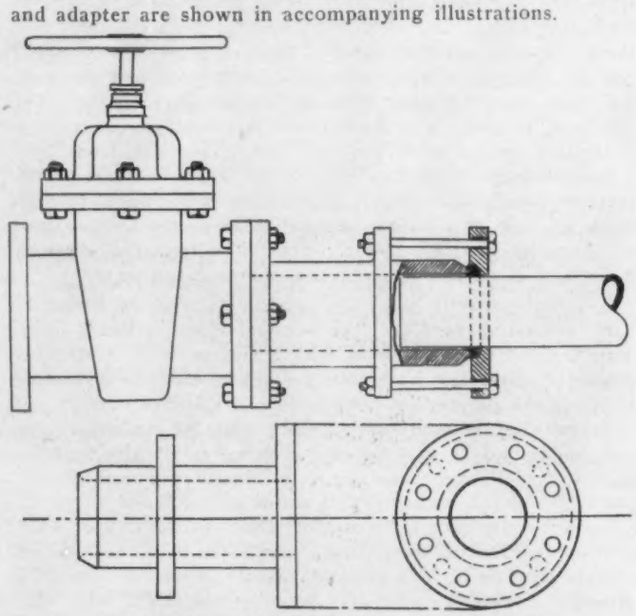
gas-generating apparatus was moved several inches on its foundation, while all cast-iron connections were more or less damaged. A 20,000-cubic-foot gas holder, in a redwood tank, was completely demolished. This adjustment of matters by the earthquake made it much easier to decide to supply this district from Martin Station.

On February 23rd, 1907, the work of laying a 4-inch steel tubing from Martin Station to Redwood City, a distance of 125,295 feet, or 23.73 miles, was begun. The inside diameter of this tubing is 3.7 inches. This pipe passes through the following suburban towns, all of which receive gas from it: Burlingame, population 900; San Mateo, population 4,600; Belmont, population 500; Redwood City, population 2,500; Fair Oaks, population 250, and the Palo Alto extension, including Menlo Park with a population of 1,200, and Palo Alto, 4,500, making a total population of 14,450.

This high-pressure line was laid with Dresser couplings, using rubber gaskets, and the flanges of the joints were drawn up tightly and evenly, to prevent the contact of the gas with the rubber, as much as possible. It is quite important in using this patent coupling, that the tightening of the bolts shall proceed evenly, so that the flanges may remain parallel. Should one side of the flange be drawn up more than another, the pressure on the rubber gasket is uneven, and the flange is apt to bind on the pipe, so that a leak is almost certain.

The painting of this line was a matter of some study, as it had previously been found that red lead and linseed oil of the best quality, although offering a good protection to the pipe, would not withstand the attacks of either the air or the soil. This pipe was therefore first thoroughly cleaned, then painted with one coat of red lead and oil, and then given a second coat of a good and well-proven metallic gas-holder paint which dries with a hard, shiny finish. It is hoped that this covering will be more durable than those formerly used.

A new pattern of drip box was used on this line, and twenty-five of them were located at various low points throughout the length of the pipe. High-pressure valves made for the purpose of holding ammonia were placed in the line at five different points, at the approach of each town. These valves were connected into the line by means of an adapter, to permit the connecting of a Dresser coupling with a flanged valve. The drip box is provided with half a Dresser coupling on each side, to facilitate its being connected into the line. Sketches of the drip box, valves and adapter are shown in accompanying illustrations.



VALVE AND ADAPTER ON HIGH PRESSURE LINE

No other fittings are used in this line, with the exception of six crosses (one at each town). These crosses are provided with adapters to Dresser couplings, and all right angles are turned by bending the pipe at a uniform radius of 20 feet.

At the completion of each day's work, the line was capped and air pressure applied to it up to 100 pounds to the square inch. This pressure was allowed to remain on the line the entire night. Testing for small leaks was done by the use of soap suds and a brush, the soap suds being applied to all parts of the coupling and to the pipe for a distance of two feet each side of the coupling, as this seems to be the vulnerable place where the pipe is apt to be split. One of the details that developed in connection with testing for leaks, is the fact that thick soap suds that has been mixed for several days is better than soap suds quickly and imperfectly mixed. The importance of careful testing is evident when it is stated that 182 defective sleeves and 29 lengths of split pipe were discarded on this line.

Much of the work was done during uncertain Spring weather, and a plow could not always be used to advantage, so that it was necessary to do much of the work with pick and shovel. A grader was used for refilling, and all of the trench, after being filled, was carefully sprinkled and rolled.

The line was completed June 1st, 1907. The actual working days required were 75. The average amount of pipe laid each day was 1,660 feet, while the greatest amount laid in a single day was 3,200 feet. The average depth of the pipe is 2½ feet. The line was placed in commission Thursday, July 18th, 1907, and not a single leak developed in any part of the line.

The gas is pumped into the line by a 14x16x12-inch steam-driven compressor, with a mechanical efficiency of eighty-five per cent, and requiring 55 horsepower to drive it, under the present conditions. This compressor has a capacity of about 22,500 feet per hour. The gas is first forced through an auto-enricher, shown on the right in the illustration.

The left-hand tank is used for the purpose of storage. These tanks are 6 feet in diameter by 32 feet long, and have a capacity of 875 cubic feet. The line itself has a capacity of 9,375 cubic feet. The twenty-five drips on the line have a combined capacity of 19 cubic feet, and the receiving tank at Redwood City, 380 cubic feet. The total capacity of the tanks and line is 11,524 feet.

The gas is received at Redwood City into a storage

AUTO-ENRICHER AND STORAGE TANK

tank 5 feet in diameter by 26 feet long.

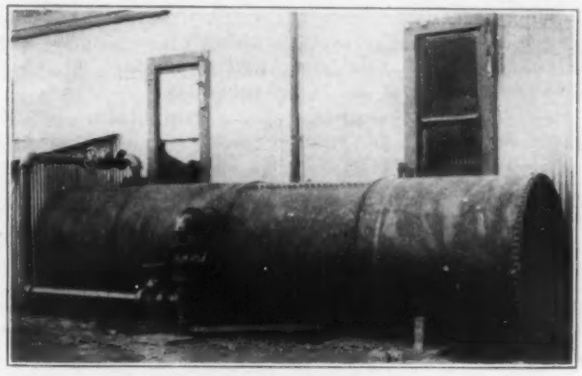
This tank is used for receiving all the gas, and from it, the various lines are fed through governors.

The four compression tanks are 6 feet in diameter by 32 feet long, and are located at Redwood City, as a reserve storage to be used in the event of an accident to the compressing machinery, or on the pipe line. The gas is taken from the receiving tank, and pumped by means of a motor-driven compressor into the four storage tanks, at a pressure of 80 pounds to the square inch. This boosting arrangement is a temporary expedient for present convenience, and is capable of many changes, as the storage tanks may be filled directly from the line and discharged automatically through the present governors, whenever there is a drop in the pressure. At the present time, approximately 100,000 cubic feet of gas per twenty-four hours is consumed through the Redwood City high-pressure line, and the line is so free from defects, and the storage capacity of the line and the three tanks (disregarding the four storage tanks at Redwood City) is so large that the compressor at Martin Station is only operated a portion of the time.

For instance, on August 30th, which was an average day, the compressor was operated from 8:00 a. m., when the pressure was 53 pounds, until 10:30 p. m., at a pressure of 66 pounds. It was then shut down until 6:30 a. m., when the pressure was 50 pounds, and was operated until 8:00 a. m., at a pressure of 55 pounds. On this day, the compressor was operated a total of 16 hours, and the greatest variation in pressure was 16 pounds. The drop in pressure

This line, completely installed, cost one and one-half

was gradual, from 10:30 p. m., from 66 pounds until 6:00 a. m., when the pressure reached 55 pounds, from 6:00 a. m. to 6:30 a. m., the pressure dropped 5 pounds, showing that the consumption of gas for the "breakfast peak" reduced the pressure 5 pounds in 30 minutes.

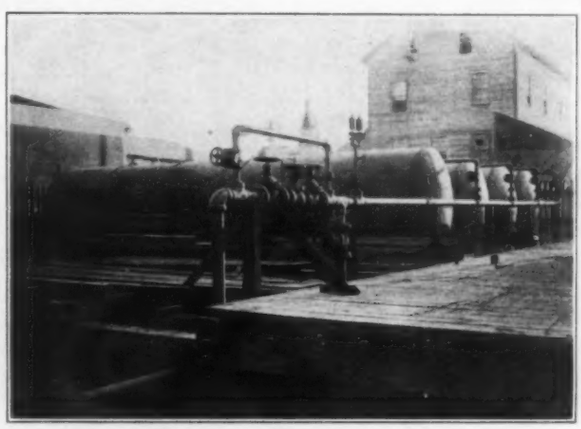


STORAGE TANK AT REDWOOD CITY

The pressure at Redwood City coincides with the pressure at Martin Station. For instance, at noon, August 11th, the pressure at both places was 50 pounds. At 1:00 p. m., the compressor was started with 45 pounds pressure at each point, and operated until 4:00 p. m., when the pressure was 55 pounds. The compressor was then shut down until 6:00 p. m., and the pressure was 50 pounds. At 10:30 p. m., the compressor was shut down with 65 pounds. The compressor was then shut down till 7:10 a. m., when the pressure at each point was 55 pounds. All of these pressures were the same at both ends of the line.

This coincidence of pressure may be accounted for bw the comparatively large capacity of the line and small consumption of gas. This is an argument in favor of large high-pressure transmission lines, and the greatest care in their installation, to ensure tightness.

This 4-inch O. D. line has an actual capacity at five atmospheres, or 58.8 pounds pressure, of 57,620 cubic feet, or an available capacity at that pressure of 46,096 feet. In speaking of atmospheres in reference to pressure, it must



FOUR COMPRESSION TANKS WITH ARRANGEMENT OF GOVERNORS

be remembered that when we say that we have five atmospheres in a tank, we do not mean five available volumes of the tank, but four available volumes, and 58.8 pounds pressure, there always being one volume or atmosphere that is not available or apparent on the gauge, and which cannot be gotten out except by exhausting the tank to a vacuum, or filling it with water.

times as much as a 2-inch outside diameter line (which would have an actual inside diameter of 1.782 inches). It has an actual holding capacity of 4.3 times as much as a 2-inch O. D. line, and its carrying capacity at equal pressures is 5.75 times that of the 2-inch O. D. line.

This installation is amply large to provide for the growth of the southern suburbs of San Francisco for many years, and will ensure excellent service to the best class of gas consumers. The average monthly consumption per meter of these consumers being 4,570 feet, which is in excess of that of most of our large cities.

In conclusion, the writer may be permitted to apply a very old saying to high-pressure gas distribution, that, like fire, it is a good servant but a bad master.

## DISCUSSION ON THE PAPER PRESENTED BY MR. E. C. JONES.

**By Edward A. Rix.**

The problem presented by Mr. Jones may be stated as follows:

In a line 125,000′ long, what size of casing is the most economical for a working pressure not to exceed one hundred pounds, where the minimum yearly quantity delivered by the pipe shall be 36,000,000 cubic feet, and the maximum 116,000,000 cubic feet, the final pressure not to exceed one pound?

In making a comparison, it will not be necessary to take into consideration the cost of trenching or laying the pipe, because within the size limits demanded by this problem these expenditures will be nearly the same. We shall consider that interest and depreciation together will be ten per cent per annum.

Experience points at once to the fact that the pipe required will be somewhere between 6″ and 2″, and we therefore may consider all these sizes and select 6″, 4″, 3″ and 2″ O. D. casing, the inside diameters being 5.60″, 3.70″, 2.72″ and 1.75″ respectively. One hundred and twenty-five thousand feet of these sizes will at present cost for the pipe and couplings in San Francisco:

$46,609.00 for 6″ pipe
32,263.00 for 4″ pipe
19,921.00 for 3″ pipe
12,780.00 for 2″ pipe

Taking 10 per cent of these values and dividing by the yearly quantity of gas, we find that for 36,000,000 feet yearly the pipe cost will be:

13 cents per 1000 for 6″ pipe
9 cents per 1000 for 4″ pipe
5.5 cents per 1000 for 3″ pipe
3.5 cents per 1000 for 2″ pipe

and for 116,000,000 feet yearly:

4.33 cents per 1000 for 6″ pipe
3 cents per 1000 for 4″ pipe
1.83 cents per 1000 for 3″ pipe
1.16 cents per 1000 for 2″ pipe

By using the formula

$$P_1^2 - P_2^2 = \frac{.00035 \times Q^2 L}{d^5}$$

which was explained and developed at our former meetings, and the tables, etc., pertaining thereto recently published by this association, we find that the various initial pressures necessary to force the desired quantities of gas through the pipes will be as follows:

**For 36,000,000 Yearly.**

4 lbs. initial pressure for 6″ pipe
16 lbs. initial pressure for 4″ pipe
44 lbs. initial pressure for 3″ pipe
160 lbs. initial pressure for 2″ pipe

**For 116,000,000 Yearly.**

18 lbs. initial pressure for 6″ pipe
66 lbs. initial pressure for 4″ pipe
160 lbs. initial pressure for 3″ pipe

leaving out the 2″ pipe as being entirely too small.

Referring now to the power cost chart in the publication before referred to, and assuming our power cost for motive power to be one cent per kilowatt hour, we have:

**For 36,000,000 Yearly.**

6″ pipe power cost per 1000 cu. ft..... .3 cents
4″ pipe power cost per 1000 cu. ft..... .8 cents
3″ pipe power cost per 1000 cu. ft..... 1.65 cents
2″ pipe power cost per 1000 cu. ft..... 3 cents

**For 116,000,000 Yearly.**

6″ pipe power cost per 1000 cu. ft..... .9 cents
4″ pipe power cost per 1000 cu. ft..... 2.1 cents
3″ pipe power cost per 1000 cu. ft..... 3 cents

Combining the cost per 1000 cu. ft. for the pipe and for the power, we have:

**For 36,000,000 Yearly.**

6″ total cost per 1000 cu. ft.....13.3 cents
4″ total cost per 1000 cu. ft..... 9.8 cents
3″ total cost per 1000 cu. ft..... 7.15 cents
2″ total cost per 1000 cu. ft..... 6.5 cents

**For 116,000,000 Yearly.**

6″ total cost per 1000 cu. ft..... 5.23 cents
4″ total cost per 1000 cu. ft..... 5.10 cents
3″ total cost per 1000 cu. ft..... 4.83 cents

All of the above data is tabulated in Table A.

Inasmuch as the joints on these pipe lines are made and tested for 100 lbs. working pressure, it is evident that any pipe requiring more than this pressure can not be considered. The 2″ pipe takes 160 lbs. pressure for the minimum quantity, and the 3″ pipe 160 lbs. for the maximum quantity. Consequently, these two sizes must be eliminated in our calculations, although the 3″ pipe is attractive on account of the lesser investment and the fact that it is good for double the minimum quantity to be pumped at an average cost. We have, however, a possible peak load of 116,000,000 to consider and must therefore eliminate the 3″ pipe. This leaves the 4″ pipe as the smallest one that will take the maximum at less than 100 lbs. pressure.

Either the 3″, 4″ or 6″ pipe could be operated at about the same cost. The 3″, however, we have eliminated on account of excess pressure; and of the 4″ or 6″ the choice would fall on the former because of the lesser initial investment, and especially as it is good for 160,000,000 at 100 lbs. pressure, and at this quantity the cost would be 4.7 cents per 1000 cu. ft. for pipe and pumping.

Comparing this cost at 160,000,000 million capacity with the cost of 9.8 cents at 36,000,000 capacity, it is evident that the price of the gas could be reduced for the consumer 5 cents per 1000 cu. ft. in order to get the increased quantity, which would be in turn much cheaper to manufacture. There would be no economy in using the 6″ pipe until 150,000,000 per year must be supplied.

San Francisco, September 14, 1907.

### DATA TABLE "A."

| | | | 36,000,000 Per Annum | | | | | 116,000,000 Per Annum | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| O. D. Casing | Inside Diameter | 5th Power | Total Cost of Pipe | Pressure Required | Power Cost in Cents | Pipe Cost in Cents | Total Cost in Cents | Pressure Required | Power Cost in Cents | Pipe Cost in Cents | Total Cost in Cents | Capacity Limit at 100 lbs. Pressure | Total Cost at Capacity Limit |
| 2 | 1.75 | 16.3 | $12,780.00 | 160 | 3.0 | 3.5 | 6.5 | | | 1.16 | | | |
| 3 | 2.72 | 150.0 | 19,921.00 | 44 | 1.65 | 5.5 | 7.15 | 160 | 3.0 | 1.83 | 4.83 | 72,000 | 5.45 |
| 4 | 3.70 | 700.0 | 32,263.00 | 16 | 0.8 | 9.0 | 9.8 | 66 | 2.1 | 3.00 | 5.10 | 160,000 | 4.7 |
| 6 | 5.60 | 5500.0 | 46,609.00 | 4 | 0.3 | 13.0 | 13.3 | 18 | 0.9 | 4.33 | 5.23 | at 160,000 | 4.5 |

## COMPARATIVE ECONOMIES IN OPERATING SMALL MOTORS BY GAS, GASOLINE AND ELECTRICITY.*

By L. H. Newbert.

I believe the subject of my paper is quite important to you all. I have therefore endeavored to handle it in a general way, hoping to draw out a full and free discussion to the end that many facts and figures may be contributed by the members of the Association from the results of their practical experience, of which the majority of you have had more than the writer.

The smaller gas and gasoline engines require a heat input of about 14,400 B. T. U.'s to develop a B. H. P., of which 11,855 B. T. U.'s are consumed in cooling, friction, etc., only 2545 being converted into useful work, which is a loss of 61 per cent. The electric motor requires an input of about 820 watts to develop a B. H. P., of which only 74 are loss, or 10 per cent. In the larger units the results will be more favorable, the loss in the electric motor being only 5 per cent and in the internal combustion motor about 75 per cent.

Large internal combustion engines are more efficient than small ones for the same reason that large steam engines are more efficient than small ones. The efficiency of a steam engine depends to a great extent on the condensation through the cylinder walls, as, with an increase in size, the power increases as the square of the diameter of the cylinder, while the condensation will only increase as the linear dimensions of the cylinder. It will be readily seen that with large gas engines the heat lost in the jacket water, which amounts to 50 per cent in small engines, will be decreased in practically the ratio stated. The mechanical friction may also be said to depend upon the same ratios. As to which is the more efficient, gas or gasoline engines, depends wholly upon the value of the fuel used.

A test made on an Otto engine using 650 B. T. U. gas showed an efficiency of 2.4 per cent in favor of gas, while the author of a standard work on oil engines writes as follows: "In trials of gasoline with gas engines of the same size and construction it has been found that the indicated horse-power from gasoline is from 12 to 20 per cent higher than from illuminating gas, when running at full load. This does not correspond with the assigned number of heat units per cubic feet of gasoline vapor and illuminating gas, for gasoline vapor has been credited with almost the same value in heat units with 16 candle power gas."

For gas engine work natural gas approaches the ideal and in the Central States, where it can be obtained at a very low figure, furnishes perhaps the cheapest power to be had—water excepted.

The testing of the power of the electric motor is an easy matter, as suitable instruments have been perfected for the work and their application is comparatively simple.

There are various methods of testing the power of the internal combustion motor, but probably the simplest and most satisfactory is by its application to generate an electric current which, by proper arrangement of detail, allows the test to be continued for a length of time and makes the test a perfectly reliable one. For this purpose the motor may be belted to a dynamo of the same or a little higher rating than that of the motor. A short wiring system with a volt and ampere meter, or an indicating watt meter and a sufficient number of lamps in circuit will indicate the power generated in kilowatts, to which should be added the loss of efficiency in the dynamo.

The ability of the internal combustion motor to do a certain amount of work, on a certain fuel consumption, depends also to quite an extent on design and construction. Some makers guarantee as follows:

12,000 B. T. U. per B. H. P. when engine is operating at full load.

14,000 B. T. U. per B. H. P. when engine is operating at three-fourths.

16,000 B. T. U. per B. H. P. when engine is operating at one-half.

A test shows the following results on several sizes of gas engines. Gas consumption at per cent of full load:

| | 25 | 50 | 75 | 100 |
|---|---|---|---|---|
| 2 H. P. using 560 B. T. U. Gas..... | 60.4 | 46.2 | 38 | 31 |
| 8 H. P. using 560 B. T. U. Gas..... | 46 | 30.6 | 31.2 | 25.5 |
| 16 H. P. using 560 B. T. U. Gas..... | 44.1 | 35 | 29 | 23.1 |
| 165 H. P. using 597 B. T. U. Gas..... | 41.2 | 34.3 | 24 | 18.3 |
| 200 H. P. using 1000 B. T. U. Gas..... | 25 | 15 | 12 | 10.5 |

The 200 H. P. engine used 10,500 B. T. U.'s at full load for each B. H. P. delivered—an efficiency of 24¼ per cent.

The writer has had some difficulty in arriving at a basis for calculating comparative costs on account of the various fuel consumption at different loads. The most favorable conditions have therefore been assumed, i. e., full load. Since California gas runs as a rule not less than 600 B. T. U.'s per cubic foot, and a series of tests at a prominent technical college showed an average requirement of one pint of gasoline per B. H. P., and it is known that 820 watts of electricity will develop a horse-power, the above quantities have been taken for the purpose of general comparison:

14,400 B.T.U.÷600= 24 cu. ft. gas per B.H.P.
1 pint 68 gasoline per B.H.P.
820 watts of electricity per B.H.P

Therefore, gas at 75 cents per 1000 cubic feet; gasoline at 18 cents, and electricity at 2.2 per kilowatt will result in equal costs of a horse-power per hour.

It is therefore evident that gas can compete with gasoline, as the expense of attendance, maintenance, etc., will be about equal. Neither gas nor gasoline, however, can compete with electric power at the extremely low price at which current is sold in quantity lots on the Pacific Coast to-day.

Great progress has been made during the past dozen years in gas engine construction and design, with the result that steam installations for the generation of electric current are steadily being replaced with the gas engine, which speaks well for the progress which has been made in mechanical engineering.

It might be interesting to some of you to know that the following results were obtained in one of the Central States where a steam plant and a gas engine plant were operated under like conditions:

The repairs on the gas engine installation during the year amounted to .00219 per kilowatt hour generated;

The repairs on the steam plant during the same period amounted to .004451 per kilowatt hour generated;

The cost of fuel for gas engine plant per kilowatt hour was .679 of the cost of fuel per kilowatt hour with steam.

At Bradford, Pennsylvania, an electric light and power company converted their steam plant into a gas engine plant, using natural gas at 10 cents per 1000 cubic feet. The steam plant burned natural gas under the boilers and required 51 cubic feet per indicated horse-power, or about 86 feet per kilowatt. Observation upon the gas engine plant showed an average consumption of 21.5 cubic feet of gas per kilowatt for all loads and conditions of operation. The total cost of operating the steam plant of 500 horse-power was about $20,000, whereas, the gas engine plant of 800 horse-power was operated at a total cost of $12,000.

The cost of installing a gas engine plant has been found to be from 25 to 30 per cent greater than for a steam plant. However, the economy of the former has been clearly demonstrated by its extended use in Europe and in this country and indicates that the difficulties formerly considered insurmountable have now been fairly overcome and that the large gas engine, for certain lines of work, can no longer be dismissed from consideration.

*Paper read before Fifteenth Annual Convention of the Pacific Coast Gas Association.

## ONE YEAR AFTER.*

By Geo. C. Holberton.

Mr. President and Fellow Members of the Pacific Coast Gas Association.—Last year Mr. L. E. Reynolds told you how electricity was served to the consumers and street car lines by the San Francisco Gas & Electric Company immediately following the fire, and I thought perhaps you might like to hear something of the results of this work and the experience which we gained and also something of what has been done since that time. Mr. Reynolds described to you in his paper the system existing at the time of the fire and what was installed immediately thereafter. There have been no practical changes or deviations from his description except that our sub-station lying between Bush Street and Fern Avenue and between Larkin and Polk has been rehabilitated, and we now have a very substantial concrete sub-station. No other sub-stations have been rehabilitated, although we have one at Mariposa and Kansas Streets which is nearing completion and we are still using temporary sub-stations which were installed at First Avenue and at Seventeenth and Folsom Streets, as well as the station near Third and Townsend and the old Kansas Street sub-station mentioned by Mr. Reynolds.

After the first troubles were over and after some of the consumers, whose buildings were not injured, were again supplied with current, the next problem that confronted us was that of supplying the temporary retail merchants; also temporary offices, saloons, etc. This was really much more of a problem than would at first seem and was one of the most difficult for the reason that the entire business of San Francisco was picked up, so to speak, from its old location and put down again on Fillmore Street and Van Ness Avenue, a territory too far removed from the old centers to enable us to use the existing system; also the load became so congested on Fillmore Street that there was actually insufficient room on the pole lines to hang enough transformers to take care of the load. Neither was it always possible to install transformers on the side streets off Fillmore Street, as the copper required would be too heavy to string on the poles. We were, therefore, obliged in some cases to build vaults in the streets, wherein we placed our transformers and then take service direct from the transformers to the heavy loads, and at the same time run a pole rise from this vault into our secondary net work. In addition to this difficulty which we experienced, the operation and maintenance department also had, of course, great difficulty in taking care of this sudden increase of load with the small amount of apparatus which was not destroyed by the fire, and which could not be increased owing to the time required by the manufacturers and the time required for shipping. The straits to which we were put may be illustrated by stating that we even went so far as to express our power-house transformers out by special cars.

The favorite evening occupation of the officers of the corporation during the evenings preceding the holidays and during the holidays was to ride around in automobiles inspecting lights and passing out the "glad hand" to consumers, telling them of the things which we were going to do to better the service and showing them how much brighter their lights were than the week before, at the same time praying that they would have time to leave the building and get into the machine before the lights went out. However, we did manage to pull through the holidays after a fashion, and by that time we began to receive additional apparatus from the East, which put us in pretty fair shape to handle the load as then existing. After that there were some few large installations in the way of theaters, such as the Orpheum, etc., which were built in the vicinity of Fillmore Street, but which were sufficieutly removed from that thoroughfare as to give us room on our poles to hang the necessary transformers.

For some months at the beginning of the present year the gain in consumers was enormous. This was also true during the fall of last year. As I recall the matter, when I came to San Francisco in September, that it was not uncommon for us to have outstanding from 1500 to 1600 electric orders, the bulk of which were connect and run service orders. After the first few months of this year the demand seemed to fall off. People were then somewhat discouraged at the existing conditions, and building operations seemed to slack off materially so that we ran as low as 300 tags uncompleted at one time, which, deducting those that it was impossible to finish, meant only two or three days' work. For the last month the conditions seem very much more active, as though people had taken fresh courage, due to more fixed conditions, and were again rehabilitating in the old districts, which entailed a large amount of work for the crews and motor setters, but fortunately it does not require a corresponding increase of work for the construction department, due to the fact that the large office buildings being built occupied a territory where our original system existing prior to the fire is still intact. Still it does entail a large amount of work in the stations and sub-stations to handle this fast increasing business. As an illustration of the amount of this, I would state that in the month just passed the San Francisco Gas & Elecric Company alone, exclusive of any of the other companies, has added to the installed load from 31,000 16-candle-power lamps and an increase in power load of about 1500 horsepower. Although this is a very large increase, I do not think it is anything like as great as we will have in the next few months, provided conditions in the city remain as at present. From this you will see that although it is now seventeen months since the fire, our conditions are still abnormal.

After the first difficulties were overcome we again examined our system more in detail and we then found many surprising conditions that were not apparent on the surface. In some localities the settlement of the street was very great, so that the conduit lines were broken; the ends setting away from each other so as to make it impossible to rod the ducts. One of the worst places was in the vicinity of the new postoffice building, where Mission Street had settled so much, as you have probably noticed in the illustrated periodicals.

Another source of expense and trouble was the chang-

* Paper read before Fifteenth Annual Convention of the Pacific Coast Gas Association at Santa Cruz, Sept. 18, 1807.

ing of the street car tracks. The United Railroads did an immense amount of work; in many cases obtaining new grades from the city, which meant the raising of our manhole castings. Then, too, as they began to clear out the debris from the basements of building sites prior to rehabilitation, they had a pleasant way of piling this on top of our service holes, which they would generally succeed in doing just as the man across the street made application for current, which necessitated our getting into that particular service hole. Another pleasant circumstance we had was with the method of construction as employed by the United Railroads in the removal of the old cable tracks. They would take one track at a time and blast this out during the night, which generally resulted in shaking up our underground system pretty thoroughly, and for fear that they might shake it up altogether, they would come along the next day on the track which was not blasted out and with a derrick lift these immense concrete blocks and carefully stack them up as high as they could, principally over our Edison mains. This generally meant that the main would be broken, as well as most of the windows in the neighborhood, and at the same time it was physically impossible to replace or even find the exact location of the burned-out tube. In some cases we were put to the extremity of taking the cable out of the manhole and running it along the curb with a box over it and into the next manhole beyond the trouble, the ends of this cable being connected to the Edison mains at either side of the break.

One of the most pleasant spots that we are obliged to tackle now is lower Market Street. There are four railroad tracks at this point, with two outer tracks varying from a few inches to 4 feet 6 inches above the inside track, the outer tracks being now in process of construction; this of course with the usual amount of material and debris being piled in the street. Then to help matters along, the City and County of San Francisco is building two sewers on the same side of the street in whatever position it pleases them, we to make the best of it and move our system accordingly. Then to help along still further, the Home Telephone Company, the City Electric Company, the Postal Telegraph Company, The Department of Electricity and the United Railroads are all building duct lines in the lower end of Market Street at the same time, but as this will hardly be considered sufficient, the Spring Valley Water Company is repairing large water mains, the Gas Company is repairing its mains, the Mutual Electric Company is fixing up its conduit system and the city is putting in new culverts, and incidentally the property owners on the side streets, feeling that they should do their share toward the upbuilding of lower Market Street, are taking advantage of the fact that the grade is to be raised 4 feet 6 inches and are piling all the debris, bricks, iron pipe, crockery, etc., on top of the various systems above referred to, and generally a few feet ahead of where we are to put a duct.

If the members are anxious to see a really pleasant mix up, I would earnestly invite them to inspect lower Market Street. This, gentlemen, will, I think, give you some little idea of the troubles that the Electric Distribution Department is having at the present time, and I do not know of anything else that we need to make their troubles more pleasant, except perhaps a few good rain storms to turn the present dust into a nice, healthy mud.

## HISTORICAL DATA—GAS AND ELECTRICITY.

### Gas.

Gas or Gaz, derivation, from "Gischt," the old German for "Geist," a "Spirit."

The honor and merit of the discovery and practical application of coal gas are due to William Murdoch, who began his expiriments in 1792, and in 1797, he lighted his premises at old Cumnock, in Scotland, with coal gas, and in 1798 the Soho Foundry at Birmingham, England, was lighted by gas.

The first public street lighting with gas took place in Pall Mall, London, on January 28th, 1807. This was due to the energy of Mr. F. A. Winsor.

The wet gas meter was invented by Clegg in 1815, and in 1820, the first dry gas meter was patented by Malm.

In 1825, Cornelius Whitehouse obtained a patent for improvements in manufacturing iron pipe for conveying gas. Wrought iron pipes were first produced at a moderate price by means of this discovery. These pipes were known by the name of "gun barrel," a name derived from the kind of pipe they had superseded.

In 1825, the dry gas governor was invented by Samuel Crosley.

In 1830, Michael Donovan obtained a patent for a method of increasing the illuminating power of gas by enriching.

The dates of incorporation of the principal metropolitan gas companies are 1810, Chartered Company; 1817, City of London Company; 1821, The Imperial Company.

In 1833, the telescopic gas holder was invented and patented by Hutchinson.

Gas purification with oxide of iron was first recommended by Croll in 1840, who obtained a patent during the year.

In 1841, the gas exhauster was invented by John Grafton.

Clay retorts were first manufactured in Scotland in 1816; while the first important use of clay retorts in England was at the "Brick Lane" station of the Chartered Company in 1844.

In 1825, benzole was discovered by Faraday, and in 1826, analine was discovered by Unverderben.

In February, 1849, the "London Journal of Gas Lighting" was established.

In 1852, "Le Journal de l'Eclairage au Gaz" was published in Paris, and in 1857, a second French periodical, "Le Gaz," was established.

In 1858, "Journal fur Gasbeleuchtung" was started in Munich, and in 1859, the "American Gaslight Journal" made its appearance in New York.

In February, 1873, Professor T. S. C. Lowe discovered the application of secondary combustion to water gas making, and started the first water gas works in the world at Phoenixville, Pa.

In 1884, the first high pressure gas distribution system was installed in Oakland, Cal., by the Oakland Gas, Light & Heat Company.

The incandescent gas mantle which made possible the Welsbach burner, and the broad range of incandescent lighting, was invented by Dr. Carl Auer von Welsbach in 1885 and 1886.

The first crude oil water gas was made by L. P. Lowe in Los Angeles, Cal., in 1889. In the early part of the same year, a crude oil water gas plant had been erected in Lynn, Mass., but was never started.

The first crude oil water gas patent was issued to Mr. L. P. Lowe in 1889.

The Pacific Coast Gas Association was organized in San Francisco, Cal., July 11th, 1893.

(To be continued.)

The JOURNAL of ELECTRICITY
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VOL. XIX SEPTEMBER 28, 1907 No. 13

# EDITORIAL.

**SOURCES OF INFORMATION FOR THE ENGINEER.**

In Europe, the solicitude with which the governing authorities look after the welfare of their subjects, is almost paternal in character. While the independent citizen of the American Republic does not require such careful supervision of private affairs as does the more helpless subject of an Empire, yet the various departments of our National Government are to-day exercising a beneficiary and supervisory control to an extent fully realized by but few.

To be more specific in our remarks, we wish to comment on the wonderful work being carried on for the benefit of the electrical and mechanical engineer by some of the branches of the various cabinet departments, and also to call the attention of our readers to the vast amount of valuable information, both pertinent and essential to their work, that is to be found in the various Government publications that are usually to be had for the asking.

Among these should be mentioned the stupendous task of the United States Geological Survey in the topographic mapping of almost all of the Western States. At a glance these maps tell the engineer all he wishes to know as to the most direct route for a pole line, the best site for a reservoir, or the most likely location for a ditch line. By consulting one of the many pamphlets issued by the Water Resources branch of the same department, he can find tabulated the annual rain fall and the average water flow of almost any district. Thus the hydro-electric engineer can arrive at a preliminary conception of the possibilities of a water system for power developments.

Also, in the line of power developments are the admirable researches that have been conducted by the fuel testing department of the United States Geological Survey at the various expositions held during the past few years. Exhaustive tests have been made of different coals, including the determination of the best sizes and the most approved methods of stoking, the ultimate object being to determine the most economical performance under different rates of combustion and best ratios of grate and heating surfaces. Producer-gas and oil are also to be tried out in service competition.

As a mirror reflecting the most advanced progress in the arts and sciences, is to be commended the report of the Smithsonian Institute, which is closely allied to much of the government work. Not to be overlooked is the excellent work on wireless telegraphy that has been authorized by the government, or the wondrous applications of electric power that have been installed by government engineers.

Hardly one engineer in a hundred realizes the great amount of valuable information that has been collected by the Department of Commerce and Labor in its annual statistical review. These are valuable, if for nothing else, in recording the rapid strides that have been made in the past few years by the modern electrical and mechanical engineers.

The most vitally important of all these undertakings, perhaps, is the conservation of timber and water that has been inaugurated by the Forest Service of the United States Department of Agriculture since the first forest reserves were established by President Harrison, in 1891. Since that time there have been established about one hundred and forty-five million acres of national forests in the United States, exclusive of five million acres that have been set apart in Alaska and Porto Rico. There has been much complaint from both biased and unbiased quarters as to hardships worked upon the innocent land holder by these reservations. That these complaints are unfounded has already been shown in our columns, and it only remains for us to reiterate the statement that timber can be purchased from the government by anyone, at reasonable prices.

Most important to the future of hydro-electric development is the maintenance of these forest reserves, as it is by them alone that we can be assured of an ample supply of water for power purposes. No one has proved that the forests increase the rainfall to any great extent, but what they do is to nurse and

conserve the rain and snow after they have fallen, the trees, brush, grass, weeds and vegetable litter literally acting as a gigantic sponge, giving an ever constant flow throughout the season. The creation of a forest reserve has no effects on the laws governing the appropriation of water. This matter is governed entirely by State and territorial laws.

The engineer, of all men, is most jealous of his time. While admitting that this great fund of information is continually at his service, yet his constant plea is the lack of time to dig it out. It is here that the modern technical journal fulfills its purpose of accurately reporting the essentials in the development of the industries with which it is associated, and presenting them to him in the state most easily assimilated. One of the severest punishments to the conscientious devotee of a progressive science is the constant feeling of being left behind, and the realization that while he is attending to his own immediate duties, things are happening everywhere that most materially effect his welfare. He must know them. He must keep abreast of the times. Alone, he is powerless. It is only by co-operation with others of his profession that he can progress. What medium is better than a technical paper?

## PUBLICATIONS RECEIVED.

As indicative of the spirit of San Francisco undaunted we depart from our custom by opening our columns to the gentle muse of poetry and print "The Dust of Frisco Town," by D. W. Taylor, as published by Paul Elder & Co., of San Francisco. The spirit in which it has been received by others is exemplified in the following extracts:

"I have always had unbounded faith in San Francisco, and she will win with colors flying, even though the dust does seem pretty thick, and is clouding the vision of the rest of the world just now."—J. L. Willard.

"We who believe in San Francisco—and I imagine any one who has ever been in that town does believe in it—know that the present condition is merely a phase in its evolution. You people who keep your courage now while the dust is thick will leave your impress on generations yet to come. A gallant fight is being made. It should have the support of all."—Byron Hackett.

### The Dust of Frisco Town.

**By D. Wooster Taylor.**

Dedicated to the Calamity Howler.

Whether you ride on a Union Bus
Or sit in a streetcar seat,
Whether you argue and fuss and cuss
And bet that Calhoun gets beat,
Or whether you walk and fume and talk
And hope that they both go down,
Remember the dust that you've kicked and cussed
Is the dust of Frisco Town.

The dust of Frisco Town, say, man,
Do you know what that dust is worth?
It's full of the life and soul and sand
Of the Best Little Town on Earth.
It's full of the blood and bone and brick
Of the men who stood staunch in her fall;
And despite every kick, that courage will stick,
For there's grit in that dust, that's all.

So whether you wander along Van Ness
And listen to tales of woe,
Or shuffle your feet up Fillmore Street
And grumble that times are slow;
Or whether you wait on Golden Gate
For an auto to take you down,
Just get this fact straight before it's too late,
That **you're** on the bum, not the town.

You're the curse of the Frisco Town, my man,
Do you know what a pessimist's worth?
He's full of the slush and milk and mush
Of the laziest man on earth.
Get busy and work and walk and sweat,
Don't whimper and fume and frown;
Union man, scab or Greek, you can get what you seek,
In the dust of Frisco Town.

So whether you swing on a wind blown beam,
With the smart of the dust in your eyes,
Where the pile-drivers steam, and the hoist engines scream
And the derricks sweep up to the skies;
Or whether you crawl on the tottering wall
Of a building that's blistered and brown,
Swear some if you must, but don't give up your trust
In the dust of Frisco Town.

The dust of Frisco Town, say, man,
Do you know how that dust was made?
It was ground from the sand of that pioneer band
Whose memory never will fade.
It is made from the pluck and the dare-devil luck
Of those Argonaut miners of old.
So don't cry till you're hurt, it's no every-day dirt,
It's dust, but it's dust of gold.

The Forest Service sends a valuable text on "The Use of the National Forests." It is written in a clear, forcible style that quickly imparts not only the manifest advisability of establishing forest reserves but also the method by which a citizen may take advantage of his privileges in the use thereof. It fulfills its purpose of showing that the reserves are for the public good. Copies may be obtained from the Forester, at Washington, D. C.

## TRADE CATALOGUE.

Crocker-Wheeler Co., 208 First Street, San Francisco, Cal., send a booklet illustrating their various types of generators, motors and transformers.

## PERSONAL.

John C. Hays has been elected president and consulting electrical engineer of the Mt. Whitney Power Co., and president of the Visalia Electric Railroad, with headquarters at Visalia, Cal.

Ernest G. Brabrook has been appointed engineer in charge of the engineering and sales office recently opened by the Link-Belt Company, at 440 New York Block, Seattle, Washington.

J. E. Bridges, of the Westinghouse Electric & Manufacturing Co., is establishing and will have charge of the Pacific Coast testing laboratory of this company in their new building at Second and Natoma Streets, San Francisco, Cal.

# LOCAL STOCKS AND BONDS

Furnished by Courtesy San Francisco Stock and Bond Exchange.

| Outstanding | INTEREST | MISCELLANEOUS BONDS. | SEPT. 20 | | SEPT. 21 | | SEPT. 23 | | SEPT. 24 | | SEPT. 25 | | SEPT. 26 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Bid | Asked | Bid | Asked | Bid | Asked | Bid | Asked | Bid | Asked | Bid | Asked |
| 1,532,000 | F & A | Associated Oil Co. 5% | .... | 80 | .... | 80 | .... | 80 | .... | 80 | .... | 80 | .... | 80 |
| 2,250,000 | M & S | Bay Counties Power Co. 5% | .... | 93 | 92½ | .... | 92½ | .... | 92½ | .... | 92½ | .... | 92½ | .... |
| 1,000,000 | F & A | Cal. Central Gas & El. 5% | .... | 100 | .... | 100 | .... | 100 | .... | 100 | .... | 100 | .... | 100 |
| 9,600,000 | M & S | Cal. Gas & El. Gen. M. & C. T. 5% | .... | 77 | .... | 76½ | .... | 76 | .... | 76 | .... | 75 | 70 | .... |
| 900,000 | J & J | California St. Cable Co. 5% | .... | 102⅓ | .... | 102⅓ | .... | 102½ | .... | 102½ | .... | 102½ | .... | 102½ |
| 2,000,000 | J & J | Contra Costa Water Co. 5% | .... | 100¼ | .... | 100¼ | .... | 100½ | .... | 100½ | .... | 100½ | .... | 100¼ |
| 1,000,000 | J & J | do do Gen. Mtg. 5% | .... | 92½ | .... | 92½ | .... | 92½ | 89 | 92½ | .... | 92½ | .... | 92½ |
| 623,000 | F M A N | Edison Light & Power 6% | 109 | 112 | 109 | 112 | 109 | 112 | 109 | 112 | 109 | 112 | 109 | 112 |
| 650,000 | M & S | Ferries & Cliff Ho. Ry. 6% | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 671,000 | A & O | Geary St. Ry. 5% | 60 | .... | 60 | .... | 60 | .... | 60 | .... | 60 | .... | 60 | .... |
| 610,000 | M & N | Honolulu R. T. & L. Co. 6% | 105 | .... | 98½ | 99¼ | 105 | .... | 105 | .... | 105 | .... | 105 | .... |
| 300,000 | A & O | Lake Tahoe Ry. & T. Co. 5% | .... | 102½ | .... | 102½ | .... | 102½ | .... | 102½ | .... | 102½ | .... | 102½ |
| 500,000 | J & J | Los Angeles Elec. Co 5% | .... | 100 | .... | 100 | .... | 100 | .... | 100 | .... | 100 | .... | 100 |
| 1,300,000 | J & J | Los Angeles Gas & Elec. Co. 5% | .... | 100 | .... | 100 | .... | 100 | .... | 100 | .... | 100 | .... | 100 |
| 5,000,000 | A & O | Los Angeles Ry. 5% | .... | 110 | .... | 110¼ | .... | 110¼ | .... | 110¼ | .... | 110¼ | .... | 110¼ |
| 1,000,000 | A & O | Los Angele Lighting Gd. 5% | .... | 103 | .... | 103 | .... | 103 | .... | 103 | .... | 103 | .... | 103 |
| 1,500,000 | A & O | Los Angeles Pac. R. R., 1st Con. Mtg. 5% | 102¾ | .... | 102¾ | .... | 102¾ | .... | 102¾ | .... | 102¾ | .... | 102¾ | .... |
| 3,030,000 | M & S | L. A. Pac. R. R. of Cal. 5% | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 3,000,000 | J & J | Market Street Cable 6% | .... | 108 | .... | 108 | .... | 108 | .... | 108 | .... | 108 | .... | 108 |
| 5,141,000 | M & S | do Ry. 1st Cons. Mtg. 5% | .... | 102 | .... | 102 | .... | 102 | .... | 102 | .... | 102 | .... | 102 |
| 100,000 | A & O | Mill Valley & Mt Tamalpais S.Ry. 5% | 103 | .... | 103 | .... | 103 | .... | 103 | .... | 103 | .... | 103 | .... |
| 4,751,000 | A & O | Northern Ry. Co. of (Cal.) 5% | 112½ | .... | 112½ | 114 | 112½ | .... | 112½ | 114 | 112¾ | 114 | 112¾ | .... |
| 1,498,000 | J & J | North Pacific Coast R. R. 5% | .... | 101 | .... | 101 | .... | 101 | .... | 101 | .... | 101 | .... | 101 |
| 1,074,000 | J & D | Northern Cal. Railway 5% | 105 | .... | 105 | .... | 105 | .... | 105 | .... | 105 | .... | 105 | .... |
| 980,000 | J & D | Northern Cal. Power Co. 5% | .... | 95 | .... | 95 | .... | 95 | .... | 95 | .... | 95 | .... | 95 |
| 6,000,000 | A & O | Northern Electric Co. 5% | .... | 97½ | .... | 97½ | .... | 97½ | .... | 97½ | .... | 97½ | .... | 97½ |
| 1,000,000 | M & S | Oakland Gas Light and H. 5% | 100 | 105 | 100 | 105 | 100 | 105 | 100 | 105 | 100 | 105 | 100 | 105 |
| 1,374,000 | J & J | Oakland Transit Co. 6% | 108½ | 110 | 108¼ | 110 | .... | 110 | 108½ | 109¼ | 108½ | 109¾ | 108½ | 109¾ |
| 1,600,000 | J & J | Oakland Transit 5% | 104 | .... | 104 | .... | 101¼ | 102½ | 101½ | .... | 101½ | .... | 102 | .... |
| 1,326,000 | J & J | Oakland Transit Con. 5% | .... | 103 | .... | 103 | .... | 103 | .... | 103 | .... | 103 | .... | 103 |
| 7,000,000 | J & J | Oakland Traction Con. 5% | .... | 99½ | .... | 99½ | .... | 99 | .... | 99¼ | .... | 99¼ | .... | 97½ |
| 1,500,000 | J & J | Oakland Water Co. gtd. 5% | .... | 100 | .... | 100 | .... | 100 | .... | 100 | .... | 100 | .... | 100 |
| 2,000,000 | A & O | Omnibus Cable Ry. 6% | .... | 112½ | .... | 112 | .... | 112 | .... | 112 | .... | 112 | .... | 112 |
| 1,149,000 | S D M J | Pacific Gas Imp. 4% | .... | 92½ | .... | 92½ | .... | 92½ | .... | 92½ | .... | 92½ | .... | 92½ |
| 8,494,000 | J & J | Pacific Electric Ry. Co. 5% | .... | 103½ | 100 | 103½ | .... | 103½ | .... | 103½ | .... | 103½ | .... | 103½ |
| 4,491,000 | J & J | Pacific Light & Power Co. 5% | .... | 98 | .... | 98 | .... | 98 | .... | 98 | .... | 98 | .... | 98 |
| 3,000,000 | J & J | Pacific Tel. & Tel. Co. 5% | .... | 102½ | .... | 102½ | .... | 102½ | .... | 102½ | .... | 102½ | .... | 102½ |
| 350,000 | J & J | Park & Cliff House Ry. 6% | .... | 104 | .... | 104 | .... | 104 | .... | 104 | .... | 104 | .... | 104 |
| 250,000 | J & J | Park & Ocean R. R. 6% | .... | 104 | .... | 104 | .... | 104 | .... | 104 | .... | 104 | .... | 104 |
| 700,000 | M & S | Powell Street Railway 6% | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 2,500,000 | M & N | Sacramento Elec. Gas & Ry. 5% | .... | 101 | .... | 101 | 99 | 101 | 99 | 101 | .... | 101 | .... | 101 |
| 6,000,000 | A & O | S. F. & S. J. Valley Ry. 5% | .... | 113 | 112¼ | 113 | 112¼ | 113 | 112¼ | 113 | 112¼ | 113 | 112¼ | .... |
| 3,000,000 | J & J | S. F., Oak. & San Jose Ry. 5% | .... | 104 | .... | 104 | .... | 104 | .... | 103¾ | .... | 104 | .... | 104 |
| 1,500,000 | J & J | do do 2d Mtg. 5% | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 1,500,000 | A & O | S. J. & S. Clara Co. R. R. 4½% | .... | 95 | .... | 95 | .... | 95 | .... | 95 | .... | 95 | .... | 95 |
| 642,000 | A & O | Sierra Ry. of Cal. 6% | 105 | 110 | 105 | 110 | 105 | 110 | 105 | 110 | 105 | 110 | .... | 110 |
| 6,000,000 | J & J | S. P. R. R. of Arizona 6% (1909) | 101 | 101½ | 101 | 101½ | 101 | 101½ | 101 | 101½ | 101¼ | .... | 101¼ | 101½ |
| 4,000,000 | J & J | do do do (1910) | 102⅛ | .... | 102⅛ | .... | 102 | 102¾ | 102 | 102¾ | .... | .... | .... | .... |
| 5,116,000 | A & O | S. P. R. R. of Cal. 6% (1912) | 108 | .... | 108 | .... | 108 | .... | 108 | .... | 108 | .... | 108 | .... |
| 4,127,500 | M & N | S. P. R. R. of. Cal., 1st c. gtd. 5% | 112½ | .... | 112½ | .... | 112½ | .... | 112½ | .... | 112½ | .... | 112½ | .... |
| 3,533,000 | A & O | S. P. Branch Ry. of Cal., 6% | .... | 125 | .... | 125 | .... | 125 | .... | 125 | .... | 125 | .... | 125 |
| 81,178,000 | J & J | S. P. R. R. Co., 1st Ref'd'g. 4% | 88 | 88½ | 88¾ | .... | 88 | .... | 88¼ | 89 | 88¼ | 89 | 88¼ | 89 |
| 17,500,000 | J & D | Spring Valley Water Co. Gen. Mtg. 4% | 85½ | 87½ | 85½ | 87½ | .... | 87½ | 85¼ | .... | 85 | 86 | 85 | 86 |
| 300,000 | M & S | Stockton Gas & Elec. Co. 6% | 100 | .... | 100 | .... | 100 | .... | 100 | .... | .... | 105 | .... | 105 |
| 2,000,000 | J & J | United Gas & Elec. Co. 5% | .... | 100 | .... | 100 | .... | 100 | .... | 100 | .... | 95 | .... | 95 |
| 20,000,000 | A & O | United R. R. of S. F. 4% | 70 | 70½ | 70 | .... | 70 | 70½ | 70 | 70½ | 70 | .... | .... | 70¼ |
| 2,500,000 | M & N | Valleys Counties Power Co. 5% | .... | 95 | .... | 95 | .... | 95 | .... | 95 | .... | 95 | .... | 95 |
| | | **Water Stocks.** | | | | | | | | | | | | |
| | | Contra Costa | .... | 62 | .... | 62 | .... | 62 | .... | 62 | .... | 62 | .... | 62 |
| 6,000 | Quarterly | Marin County | 45 | .... | 45 | .... | 45 | .... | 45 | .... | 45 | .... | 45 | .... |
| 280,000 | .... | Spring Valley Water Co. | 22 | 22½ | 22 | 22½ | 22 | .... | 21½ | 22 | 21½ | 22 | 21 | 21½ |
| | | **Gas and Electric Stocks.** | | | | | | | | | | | | |
| 37,500 | .... | Martel Power Co. | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 9,340 | .... | Mutual Electric Light Co. (Ctfs.) | 4½ | .... | 4½ | .... | 4½ | .... | 4½ | .... | 4½ | .... | 4½ | .... |
| 37,336 | .... | do (Extended Ctfs.) | 13 | .... | 13 | .... | 13 | .... | 13 | .... | 13⅜ | .... | 13⅜ | .... |
| 40,000 | Monthly | Pacific Lighting Co. | 65 | .... | 65 | .... | 65 | .... | 65 | .... | 65 | .... | 65 | .... |
| 12,000 | .... | Stockton Gas & Elec. Co. | 52 | .... | 52 | .... | 52 | .... | 52 | .... | 52 | .... | 52 | .... |
| | | **Street Railroad Stocks.** | | | | | | | | | | | | |
| 10,000 | .... | California | .... | 140 | .... | 140 | .... | 140 | .... | 135 | .... | 135 | .... | 135 |
| 10,000 | .... | Geary | .... | 35 | .... | 35 | .... | 35 | .... | 35 | .... | 35 | .... | 35 |
| 10,000 | .... | Presidio | .... | 25 | .... | 25 | .... | 25 | .... | 25 | .... | 25 | .... | 25 |
| | Semi-an. | Associated Oil Co. | 28½ | 28¾ | 29 | 29¼ | 28½ | 29 | 28⅞ | 29½ | 28½ | 28¾ | 28½ | 29½ |
| 1,625 | Quarterly | Mill Valley & Mt. Tamalpais S. Ry. | .... | 110 | .... | 110 | .... | 110 | .... | 110 | .... | 110 | .... | 110 |
| 180,000 | Quarterly | Pac. Tel. & Tel. Co. (Pfd.) | 81 | .... | 81 | .... | 81 | 85 | 81 | .... | 81 | 85 | 81½ | 85 |
| 180,000 | .... | Pac. Tel. & Tel. Co. (Common) | 10 | .... | 10 | 11 | 10 | .... | 10 | .... | 10 | .... | 10 | .... |

## Unlisted Securities

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 750,000 | A & O | Bay Counties Power Co. 6% | 97 | .... | 97 | .... | 97 | .... | 97 | .... | 97 | .... | 97 | .... |
| 745,000 | M & S | Blue Lakes Water Co. 6% | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 2,000,000 | A & O | California Northwestern Ry. 5% | .... | 108 | .... | 108 | .... | 108 | .... | 108 | .... | 108 | .... | 108 |
| 160,000 | J A J O | Marin County Water 5% | .... | 100 | .... | 100 | .... | 100 | .... | 100 | .... | 100 | .... | 100 |
| 600,000 | J & J | Risdon Iron Works 5% | .... | 100 | .... | 100 | .... | 100 | .... | 100 | .... | 100 | .... | 100 |
| 500,000 | M & S | S. F. Dry Dock 5% | 100 | 109 | 100 | 109 | 100 | 109 | 100 | 109 | 100 | 109 | 100 | 109 |
| 8,000,000 | M & N | S. P. Gas & Electric 4½% | .... | 95 | .... | 95 | .... | 95 | .... | 95 | .... | 95 | .... | 95 |
| 3,926,000 | J & J | S. F. & North Pacific Ry. 5% | .... | 104 | .... | 104 | .... | 104 | .... | 104 | .... | 104 | .... | 104 |
| 5,500,000 | J & J | South Pacific Coast Ry. 4% | .... | 91 | .... | 91 | .... | 91 | .... | 91 | .... | 91 | .... | 90 |
| .... | .... | Standard Electric Co. 5% | .... | 85 | .... | 85 | .... | 85 | .... | 85 | .... | 85 | .... | 85 |
| .... | .... | do do Gtd. 5% | .... | 85 | .... | 85 | .... | 85 | .... | 85 | .... | 85 | .... | 85 |
| 750,000 | J & J | Sunset Tel. & Tel. Co. 6% | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 2,250,000 | A & O | Sunset Tel. & Tel. Co. 5% | .... | 103½ | .... | 103½ | .... | 103½ | .... | 103½ | .... | 103½ | .... | 103½ |
| 1,000,000 | M & N | Sutter Street Railway 5% | .... | 103 | .... | 103 | .... | 103 | .... | 103 | .... | 103 | .... | 103 |
| | | **Stocks.** | | | | | | | | | | | | |
| 50,000 | Monthly | Gas Consumers' Association | 17½ | 20 | 17½ | 20 | 17½ | 20 | 17½ | 20 | 17½ | 20 | 17½ | 20 |
| 100,000 | Monthly | Northern Cal. Power Co. | 24 | 25 | 24 | 25 | 24⅜ | 24¾ | 24⅜ | 25 | 24¾ | 25 | 24⅜ | 25 |
| .... | .... | Pac. Gas & Elec. (Pfd.) | 40 | 47½ | .... | 47½ | .... | 47½ | 40 | 47½ | 40 | 47½ | 40 | 47½ |
| .... | .... | Santa Cruz Port. Cement | .... | .... | 40 | .... | 40 | 50 | 45 | .... | .... | 50 | .... | 50 |
| .... | .... | Standard Port. Cement (New) | .... | 50 | .... | 52½ | .... | 50 | 40 | 50 | 40 | 50 | 40 | 50 |
| 50,000 | Monthly | Truckee Electric Co. | .... | 15¼ | .... | 15¼ | .... | 15¼ | .... | 15¼ | .... | 15½ | .... | 15½ |

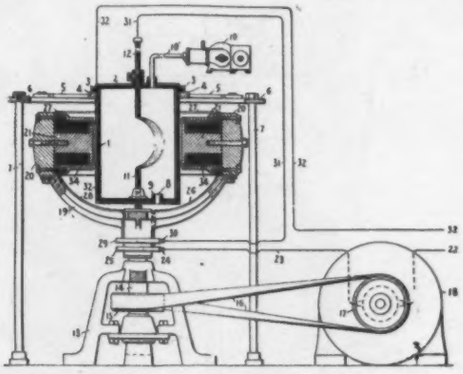
# PATENTS

**Electric, Gas and Water.**

Specially reported for the Journal of Electricity, Power and Gas.

PRODUCTION OF NITROUS COMPOUNDS. 865,618. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company.

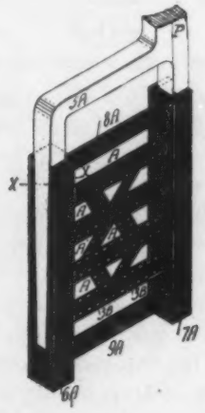
The process of producing the chemical combination of



nitrogen and oxygen, which consists in establishing an electric arc of minimum volume and maximum length, deflecting and rotating the arc magnetically, and causing a current of atmospheric air to pass through the space of rotation of the arc.

ELECTRICAL ACCUMULATOR. 865,503. John Knobloch, New York, N. Y.

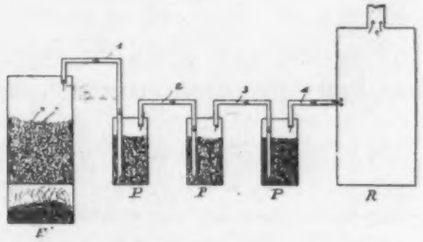
In an electrical accumulator having an element comprising a plurality of units, units consisting of a conducting support, having consecutive compartments, and a suitable



electrolytically active paste carried thereby, a perforated envelop of insulating material, surrounding the whole, together with a frame of insulating material to support the element and a woven binder of insulating material, embracing and securing the units.

PROCESS OF OBTAINING GAS FROM PEAT. 865,537. James E. Smith, Clinton, Iowa, assignor to National Peat Products & Chemical Company, a corporation of South Dakota.

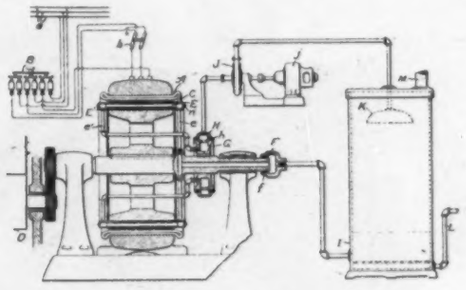
The process of obtaining illuminating gas from peat, which consists in subjecting fresh dried peat to the action



of heat, whereby gas is driven therefrom, then purifying the gas obtained by passing it through dry peat, and then adding the peat through which the gas has been passed, to the fresh peat to be heated therewith to cause enriching it so as to be added to the gas.

INDUCTION MOTOR. 865,617. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York.

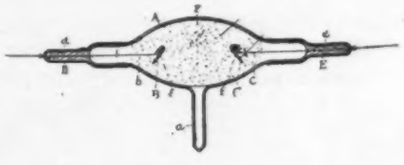
In an induction motor, a secondary winding comprising



hollow conductors of high resistance, a pipe connection from one end of conductors to a fluid reservoir, and a pipe connection from the other end of conductors to a suction pump.

FLUORESCENT ELECTRIC LAMP. 865,367. Thomas A. Edison, Llewellyn Park, N. J.

In a fluorescent electric lamp, the combination of a



vacuum tube and a fluorescent screen excited thereby and composed of glass, and a crystalline powder fused thereto.

POLE-BASE. 864,854. Maurice H. Murray, Bakersfield, Cal.

A device comprising a concrete base having longitudinally reinforcing straps therein, the straps being arranged in opposed pairs, with the pairs of straps at angles to each other and with the bottoms of the pairs connecting and crossing, the ends of the straps being extended from the base for attachment to a super-structure.

# INDUSTRIAL

## EFFECT OF STATIC AND RUNNING FRICTION ON ACCURACY OF INDUCTION METERS.

By J. E. Bridges and H. W. Young.

The induction integrating watt-hour meter has come into such extended use that the majority of central-station managers are familiar, in a general way at least, with the electrical and mechanical merits or demerits of the various types. With the increased knowledge of the possibilities of the induction type of meter, have come demands for increased accuracy, and these demands have resulted in a refinement of design little contemplated by many users, and even designers, a few years ago.

In general it may be said that a point has now been reached where efforts toward making improvements must largely be directed towards a refinement of details, as the

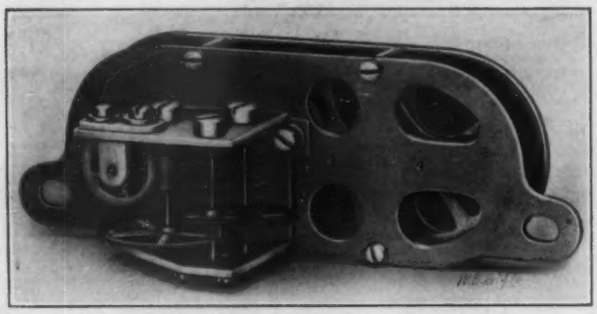


FIG. 1. METER REGISTER WITH SLOW SPEED WORM

essential fundamentals of a commercial meter have been well established. What might be called the meter's measure of worth, or its ability to give and maintain a high degree of accuracy, is vitally dependent upon the amount of friction, especially at the lower parts, and it is the purpose of this article to consider this feature only.

The evil effects of friction upon the accuracy of meters are too well known to require undue emphasis, and the designers' efforts have constantly been directed toward decreasing the friction value. Meters with high static friction will not register so accurately as meters in which this value is low, and meters with high-running friction cannot quickly and accurately respond to rapid-load fluctuations.

As is well known, the weight of the revolving elements has a very important bearing upon the accuracy obtainable in meters, especially owing to the evil effects of heavy weights on jewel wear. Designers have largely directed their efforts toward a reduction in weight of the rotating element, so that in the modern induction meter the weight on the jewel seldom exceeds eighty grammes, and in some meters is low as fifteen grammes. This consistent trend toward lighter moving elements demonstrates that engineers are fully alive to its desirability and the beneficial effect on accuracy, especially at light loads. It is evident, however, that a point will be reached when further reduction is impracticable, owing to mechanical considerations, and in order to still further reduce the friction value, it becomes necessary to consider the three remaining elements, namely,

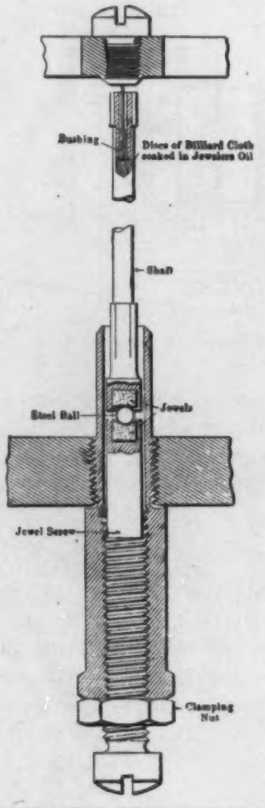



FIG. 2. UPPER AND LOWER BEARING OF SHAFT

registers, top-bearing and lower-bearing, all of which have a direct bearing on the meter's static and running friction.

In comparison with the effect of friction at the lower bearing, it must be conceded that the friction introduced by the registering mechanism is of much less importance—in fact, if a new meter be tested with register in place and re-tested with the register removed, it will be found difficult to detect any error in the calibration curve. If, however, the above test is made after the meter has been in service for two or three years, it will be found that an appreciable effect is present, especially if the register's gears and pinions are corroded or "gummed."

The design and construction of the register obviously has a decided influence upon the friction value. It must be conceded that a register employing improperly-cut gears or shafts made of brass, resting in bearings made of the same material, cannot (assuming equally good workman-

ship) have so low a friction value as a register employing polished and hardened steel shafts, resting in brass bearings. In other words, "unlike" metals make better bearings than "like" metals.

The tendency of registers to corrosion, referred to above, can readily be eliminated by gold plating the various surfaces, thus covering them with a homogeneous jacket, free from any corrosive action.

The method of transmitting the motion of the disk shaft to the register is also of much importance. In the register illustrated in Fig. 1 it will be noted that the worm is located in the register mechanism itself, rather than on the disk shaft. The reason for placing the worm back in the gearing is that a worm is a relatively poor power-transmitting mechanism, and as the speed increases the efficiency is reduced. Therefore, a worm located on the shaft is subject to a comparatively high speed, as it necessarily

FIG. 3. SINGLE PHASE INDUCTION METER EQUIPPED WITH BALL BEARING

runs at the disk-shaft speed; for instance, a meter having a full-load disk speed of thirty revolutions per minute, would have a worm speed of 1,800 revolutions per hour, as compared to a worm speed of twenty-four revolutions per hour, as secured in registers in which the worm is placed back in the gearing.

The use of a worm on the disk shaft also introduces friction, due to the lifting or pulling action of the disk under load conditions. This action has a tendency to bind the worm against the teeth of the first wheel, and this binding necessarily introduces friction. The use of a shaft pinion, as found in the later meter designs, eliminates excessive friction at this point.

Friction at the top bearing is frequently present to an undue degree, especially if the alignment is bad. A common form consists of a drilled brass plug forming a guide or steady bearing for a small needle-like projection on the disk shaft. In the later design this bearing has been superseded by that shown in Fig. 4. It will be noted that the bearing pin is fastened to a removable screw, and the top of the disk shaft is drilled and bushed. At the bottom of the shaft hole is placed a felt disk saturated with watch oil, and, as the bearing pin just touches this felt, a thin film of oil is drawn up between the bushing and pin, resulting in perfect lubrication and necessarily low friction.

Assuming a meter to be so designed electrically that it is initially accurate and so designed mechanically that it cannot easily be thrown out of adjustment, the most important quality is the ability to maintain its initial accuracy for long periods of service, with minimum attention and expense for maintenance. The type of lower bearing employed determines this quality, and the problem has been very successfully solved by the construction shown in Fig. 2, which illustrates an improved form of bearing consisting of a highly-polished and hardened steel ball-bearing resting between two cupped sapphire jewels, one of which is

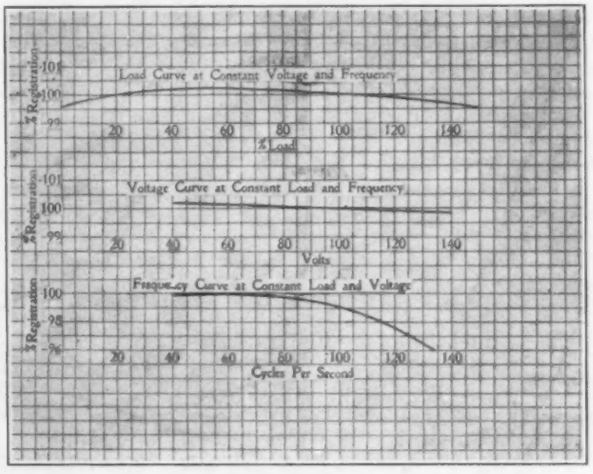

Load Curve at Constant Voltage and Frequency
% Load
Voltage Curve at Constant Load and Frequency
Volts
Frequency Curve at Constant Load and Voltage
Cycles Per Second
% Registration

FIG. 4. CHARACTERISTIC CURVES OF INDUCTION METER EQUIPPED WITH BALL BEARINGS

mounted on a removable jewel screw, and the other in a removable sleeve attached to the lower end of the disk shaft.

The action of the bearing is as follows: As the disk rotates the ball moves from its initial position, thus giving a rolling action rather than the straight rubbing action found in the older form of bearing. A changing point of contact between bearing surfaces is thus secured and insures a lower friction value and longer jewel life with minimum wear than can possibly be secured by the older forms, especially when combined with a light-weight rotating element.

To those who have not investigated this roller type of bearing and are unacquainted with its action, it may seem that a change of contact surfaces does not occur, and they may be led to believe that rather than a rolling action it merely results in spinning of the ball on its jewel centers, thus giving two points of friction contact and in reality resulting in a greater total friction than would be found in the older form of bearing which had but one point of contact.

Theoretically, a spinning rather than rolling action of the ball is possible, but to bear out this theory it is essential to have a condition impossible to obtain or maintain commercially, namely, an absolutely perfect alignment between the upper and lower jewel centers. This condition would hold the ball in practically its initial position, resulting in spinning on one or both of the jewel centers.

It is obviously impossible, however, to secure this condition of perfect alignment, owing to inevitable variations in

jewels, screw threads, machine drilling of holes and magnetic side pull of the disk seeking a magnetic balance. Any of these conditions will throw the jewels slightly out of alignment, and with centers a trifle off it will be seen that the ball must roll or revolve. Other factors which induce the rolling effect are external or internal vibration—external from the support to which the meter is secured, internal due to the slight disk vibration in the magnetic field. Examination of a ball which has been running in jewels containing a small quantity of dust or cutting material will show it to be surface scratched all over, another proof that it has rolled.

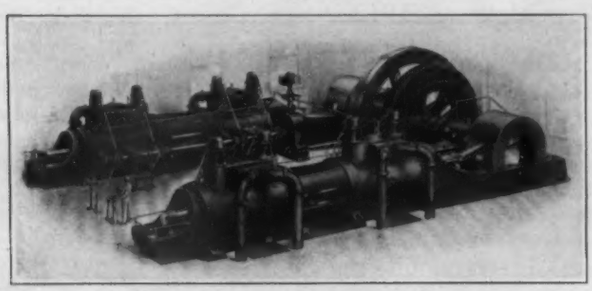
In determining upon the type of meter to be employed it should be borne in mind that a meter is essentially a very small motor-generator set, expending a certain amount of constant or useful work in driving the edge of a disk through a permanent magnetic field and expending a certain amount of variable or useless work in overcoming friction in the register, top and lower bearings. The ratio between this useful and useless work or the "ratio of torque to friction" is the real determining factor in judging the accuracy to be expected, for it will be readily seen that a perfect meter would have no friction and, therefore, have nothing to impair its accuracy. The further departure from the perfect meter by introduction of static or running friction, the less able it is to give or maintain accuracy, especially over long periods of service.

Fig. 3 illustrates an induction meter equipped with a light moving element and ball-bearings, and Fig. 4 the characteristic curves. The slight effect of wide variations in voltage and frequency is also of interest.

## ALLIS-CHALMERS GAS ENGINES.

The accompanying illustration shows the type of gas engine now being built by Allis-Chalmers Company, Milwaukee, for the powerhouse of the Indiana Steel Company's new works at Gary, Indiana, and for other large installations as mentioned below.

These engines have the largest cylinder diameter of any gas engine yet built in this country, the sizes being 44 inches in diameter by 54 inches stroke. They have the same volumetric capacity as the engines built for the California Gas &



ALLIS-CHALMERS 4 CYCLE, DOUBLE-ACTING, TWIN TANDEM GAS ENGINES, DIRECT CONNECTED TO 2000 KW A. C. GENERATOR

Electric Company, which are 42 inches in diameter by 60 inches stroke. An engine of this size on blast furnace gas of about 80 to 85 B. T. U. will give a safe maximum horsepower in the neighborhood of 4000 but will work up to approximately 5000 horse-power on the richer gases. The valve gear is located between the engines, concentrating the gear on a twin tandem in a way that makes it very convenient for the operating engineer. This engine, as shown, is of the cut-off type, the quantity of gas and the time of admission both being under the control of the regulator. In one power-house at Gary there will be 17 units, 15 of which will be connected to 25 cycle alternators (rated at 2000 kilowatts, but which will, of course, have large overload capacity) and two will be direct-connected to direct current generators, also of 2000 kilowatt rated capacity. The power-house is 125 feet wide and 1000 feet long. Another power-house being built at Gary of the same width and one-half this length is also to be equipped with similar gas engines.

The weight of the engine is 1,500,000 pounds; the crank pins are 20 inches in diameter; the shaft is 30 inches in diameter in the bearing; and the fly-wheel is 23 feet in diameter, weighing 200,000 pounds. The speed of this engine is 83⅓ revolutions per minute. The pistons and rods are water cooled, water being introduced at the center and flowing forward to a discharge in the frame for the front piston and backward to a discharge in the tail guide for the rear piston, each piston having its separate supply. For dismantling or for cleaning, the rod is made in two parts, joined at the central slide, the rear half going out at the rear of the engine, and the other half going out through the frame, which is made open at the top for convenience.

The frames for this engine weigh approximately 90 tons each, and one-half of each frame is buried in the foundation, in order to raise the floor line to a point which will make the slides on the valve gear readily accessible.

Within the past year Allis-Chalmers Company has taken orders for 36 gas engines of 4000 horse-power each, or an aggregate of 144,000 horse-power, 25 of which are to be installed as a part of the mammoth new plant now in course of construction by the Steel Corporation at Gary, Indiana; seven for the Homestead Plant of the Carnegie Steel Company and four in the South Chicago Works of the Illinois Steel Company. It will require 2300 cars to transport these machines from the works of the Milwaukee Company to the different plants of the Steel Corporation, where they will be installed.

The wide use of gas engines by the United States Steel Corporation marks an important step in the progress of steel manufacture in this country, as they are designed to operate upon the hitherto "waste" gas developed by the blast furnaces; thus inaugurating an important economy in steel production.

The majority of the Allis-Chalmers gas engines on order will drive electric generators of standard Allis-Chalmers type, 25 cycle, 3 phase. These machines are to be used for generating the necessary power to operate the heavy induction-motor driven rolls, the tilting and feed tables for the various passes, the hot saws, hot and cold pull-ups, transfer tables, straightening machines, and cold saws, and other auxiliary machinery of the mills which is now ordinarily operated by means of steam power.

In addition to the gas engine driven electrical units, orders have also been placed with the Allis-Chalmers Company for 12 gas-driven blowing engines. The Indiana Steel Company, Gary Plant, will have eight blowing engines, and the Homestead Plant of the Carnegie Steel Company has ordered the remaining four units. Each blowing-engine has a capacity of 3500 horse-power, and will deliver 30,000 cubic feet of free air per minute against a pressure of 18 pounds per square inch, which is ordinarily the maximum. Eleven of the gas-driven blowing engines purchased by the steel company's plants will be equipped with "slick" type blowing tubes, the American patent rights covering which are owned by Allis-Chalmers Company.

In steel plants where steam-driven blowing engines have heretofore been using steam furnished by boilers utilizing waste gases from blast furnaces, it is ordinarily found that the amount of gas is at times not sufficient to supply the required power for this purpose only. But the same gas when used in gas engines not only furnishes sufficient gas for supplying all the air required by the furnaces, but also a considerable quantity over and above the requirements, which is used, as in the present instance, for driving electric-generating units supplying sufficient power for the other uses common to the steel mill.

# NEWS NOTES

## TRANSMISSION.

Red Bluff, Cal.—The Northern California Power Company has begun preliminary work in building a new power plant on Battle Creek. A gang of twenty-five Greeks, with a promiscuous lot of baggage, arrived last week and will be taken out to help construct a large dam at the power site.

Los Angeles, Cal.—Work on the second hydro-electric plant of the Edison Electric Co., on Kern River, will soon be started. There will be five stations, with an aggregate output of 90,000 horsepower of electric energy. V. P. Edmonson states that there will be a market for the company's power and for the city's power that may be developed in connection with the aqueduct.

Plateau, Cal.—The Northern California Power Co., which has in operation three power houses, two at Volta and one at Kilare, and which has begun the erection of a fourth at the junction of the north and south forks of Battle Creek, is now contemplating the erection of a fifth power house on South Battle Creek. The company has acquired possession of the old George Hagen place with its large springs of water. A party of surveyors, led by Dick Gernon, of Red Bluff, is now making the preliminary surveys in the South Battle Creek country.

Reno, Nev.—Richard Phelan, of Sierra County, Cal., is in this city with two of his engineers, and declares that he intends to bring an electrical power line into his city from power plants he is now having constructed on the Yuba and Feather Rivers and at Gold Lake, in the western portion of California, and that when his line into Reno is completed, he will cut the present rates of the Reno Power, Light and Water Co. and the Truckee River General Electrical Co. in two. He states that he already has his power plants in the course of construction, and that, when completed, hey will furnish more han 42,000 horsepower.

Stockton, Cal.—The Stanislaus Electric Power Company will have to bring about seventy-five condemnation suits in San Joaquin County to run its system through Stockton. The landowners have refused to grant rights of way unless paid fancy figures for the privilege of placing the largest steel towers on their property, but the company's agents declare they will not accede to the demands, as the land is not damaged in the least by the high wires. Some of the landowners have asked as high as $5,000. Where reasonable figures have been asked for the right, the company's agent has paid cash for the privilege, and deeds have been secured for the line from Vallecito, in Calaveras County, to the Atlanta section of San Joaquin County, where trouble was found. The company is building a $10,000,000 plant in the Sierras, and is rushing the work to deliver electricity in San Francisco early next year.

## FINANCIAL.

San Francisco—A meeting of the stockholders of the Palmer Oil Co., will be held November 18th, at the Crocker Building, to consider and act upon a proposition that capital stock be increased from $1,000,000 to $2,000,000.

San Francisco—A special meeting of the stockholders of the Pacific Gas and Electric Co., will be held November 20th, at Franklin and Ellis Streets, to consider and vote upon a proposition to increase the bonded indebtedness from $10,350,000 to $14,350,000.

Los Angeles, Cal.—The Tejunga Power and Water Company has been incorporated with a capital stock of $250,000. The company will develop water in Little Tejunga Canyon, and distribute it for irrigation. C. F. Hunter, Gen. J. Jones, F. I. Wilson, H. C. Seber, Dr. J. W. Trueworthy, Dr. J. E. Cowles, J. B. Ashby and others are directors.

Los Angeles, Cal.—Ordinance 15,346 has been adopted to provide for the issuing of bonds of the city of Los Angeles, in the sum of $1,020,000, being part of the $23,000,000 issue authorized by election June 12, 1907, for water works to convey water from Owens River Valley to Los Angeles. These bonds are to be of denomination of $1,000, with interest at 4 per cent. Bonds to number 1,020, payable as follows: Thirty on October 1, 1914, and the same number each year on the same date.

Los Angeles, Cal.—The State Board of Examiners has voted to subscribe half. of the issue of $1,020,000 bonds, with the understanding that the other half be taken by the Los Angeles banks. The report has been corroborated by Attorney W. V. Mathews. Among the banks said to have agreed to subscribe are: The American National, $100,000; Citizens' National, $40,000; the First National, a large block. The first issue will be devoted to the tunnel work at Elizabeth Lake. Chief Engineer Mulholland is now on the ground arranging for this 5-mile bore.

Santa Cruz, Cal.—Owing to difficulty in floating its bonds, it is doubtful whether the Ocean Shore Railroad will be able to have a line in operation between San Francisco and Santa Cruz within the coming year. Such is the statement given out for publication by J. Downey Harvey, president of the Ocean Shore road. He says that if three hundred citizens of Santa Cruz County would each be willing to take one $1,000 bond of the Ocean Shore Railroad he could positively guarantee the completion of a single track before another year. Harvey intimates that owing to the conditions that prevailed after the San Francisco fire, it was a hard matter to dispose of bonds in the East. The Ocean Shore at present runs three miles the other side of the cement works at San Vicente, a distance of eighteen miles, and since it has been in operation it has paid well.

## TRANSPORTATION.

Ventura, Cal.—F. M. Packard and J. P. Jones, of Los Angeles, have applied to the Supervisors for a franchise for an electric line from Ventura to Nordhoff.

San Diego, Cal.—The San Diego Railway Co. has been granted an extension of time until April 1, 1908, to complete the First and State Street lines. The difficulty of getting material was given as the reason.

San Diego, Cal.—E. S. Babcock announces that he has arranged for the installation of a power plant for the electrization of the line to La Jolla. He has purchased the plant of the Los Angeles-Pacific system at Sherman. The plant will be shipped here.

Hollywood, Cal.—There are two bidders for the franchise on Highland Avenue, from the north to the south city boundary. M. A. King, of the proposed Pasadena and San Fernando Valley road, was one of the bidders, but the Los Angeles-Pacific raised the bid to $1,000, and were awarded the franchise.

Stockton, Cal.—The Central California Traction Co. wants to land its passengers from Lodi and other points right at the Southern Pacific and Western Pacific depots. As it now is, its route is unsatisfactory, and does not come within a block of the nearest station. The electric line plans to abandon its Aurora and Market Street franchises if the permission to go from Weber to Aurora and from Weber to Market on Pilgrim is granted.

San Francisco—The joint committee on Public Utilities and Streets of the Board of Supervisors decided to recommend the final passage of the ordinance granting the franchise for a street railway in Parkside to the Parkside Transit Company, with four additional conditions imposed in a stipulation to be signed by the officials of the company. The committee's report in all likelihood will be adopted by the Board, and the fourteen votes necessary to pass the ordinance will be forthcoming.

Los Angeles, Cal.—The Trustees at Wilmington have granted to H. E. Huntington a right to occupy and cross certain streets enabling the Pacific Electric to build a double track along the shore from Wilmington to the San Pedro Interurban line. The Pacific Electric Company will abandon the long trestle or sell it to the Southern Pacific Company. The Southern Pacific will be compelled to build a two-track drawbridge over the channel into the west basin. The Pacific Electric is freed from a similar expense by the action of the Trustees.

Napa, Cal.—All the steel rails on hand for the St. Helena extension of the San Francisco, Vallejo and Napa Valley Electric Railroad have been laid, thus extending the track as far north as Oakville. The officials have received word from the American Hawaiian Steamship Co. that two shiploads of rails are expected here in a few days. The roadbed is graded to St. Helena, and all necessary bridges along the road are finished, with the exception of the bridge which spans the White Sulphur Creek near St. Helena. The delay is due to the action taken by the Board of Trustees of St. Helena

San Francisco—The North Shore Electric Company has decided to improve the electric service to Fairfax before next Spring. To do this an expenditure of $33,000 will be necessary for the purchase of electric machinery, installation and enlarging of the power house. The management has decided to abandon storage batteries at the San Anselmo sub-station and to install in their stead two 500-kilowatt motor generators. The storage batteries develop ordinarily 450 volts, and the motor-generators will develop 600, the same potential as at the Alto power house. There will be enough ground space left in the sub-station for four more motor-generators of the same capacity. As the company contemplates extending the electric service to Point Reyes before long, this space will be utilized for motor-generators for that extension. Electric trains will be run to Fairfax as soon as the motor-generators are installed and the equipment of twelve cars arrives from the East. The equipment consists of eight coaches and four motors, costing $107,000.

## ILLUMINATION.

Benson, Ariz.—John Metz, of Tucson, has been at Benson arranging to install a lighting plant there. He has petitioned the Supervisors for a franchise.

Berkeley, Cal.—Citizens of West Berkeley, for a considerable time, have agitated the question of the need of gas mains in their section, and now it is understood that the Oakland Gas, Light and Heat Co. is inclined to consider an extension of its lines favorably.

Newark, Cal.—At the last meeting of the Board of Supervisors a petition was read from Geo. C. Higgis, of Newark, asking for the privilege of building, operating and maintaining gas works in Newark, which includes the running of mains and supply pipes through that town. The application was referred to the District Attorney.

San Jose, Cal.—There is some talk of a municipal lighting plant here. At present the United Gas and Electric Co. holds the contract for lighting the streets. The contract expired June 30th, and in response to a widespread public sentiment, Mayor H. D. Matthews sent to the Council a message urging that body to make appropriations for a municipal plant. The Mayor calls attention to the fact that the street lighting last year cost the city over $12,000, and the cost next year promises to reach $14,000. This cost, the Mayor claims, could be materially lessened under municipal ownership. Mayor Matthews said: "I am unqualifiedly in favor of establishing a municipal lighting plant as soon as the contract with the company expires next June. Municipal ownership has proved to be an almost uniform success in other cities, and I would like to see it instituted in San Jose. The lighting of the city is something that vitally affects the well-being of every person who lives within the city limits, and a utility in which the people are so deeply interested should be owned by the people themselves." While the Council as yet has taken no official action, the members of the body express themselves favorably in regard to the Mayor's recommendation, and it is probable that an appropriation for a municipal plant will soon be voted. Meanwhile, the Mayor will appoint an electrical engineer to investigate the cost of the proposed plant.

## TELEPHONE AND TELEGRAPH.

Ellensburg, Wash.—F. S. Hayward of Twin Falls, Idaho, is endeavoring to establish an independent phone system here.

Anacortes, Wash.—The new building for the Farmers' Mutual Telephone Company on Fifth Street will soon be ready for occupancy.

San Francisco—The sum of $15,000 for a new fireproof brick building to accommodate the department of electricity and the fire and police alarm systems has been recommended by the Supervisors' Finance Committee.

Portland, Ore.—Chas. E. Sumner, president of the Home Telephone Company, of Cleveland, Ohio, is in this city to attend to the taking over of all preliminary work and installation of 8000 Home telephones from the Empire Electric Company, which has contracted to install the system.

Carson, Nev.—There is widespread interest locally over the action which the City Council will take in reference to the applications for telephone franchises filed by two companies who would enter the field as rivals to the Sunset service. The Salt Lake Telephone Co., represented here by J. M. Rich, is making a strenuous effort to secure a permit to erect poles, while the Nevada Consolidated Co., composed of local capitalists, seems to have the inside track. The directors of the Nevada Consolidated have just elected the following officers: President, J. F. Adams; Vice-President, Malcolm MacDonald; Second Vice-President, H. F. Danberg; Secretary-Treasurer, James G. Eweeney.

## WATERWORKS.

Oakland, Cal.—At the meeting of the Council recently the Board of Public Works plan to install an auxiliary salt water pumping plant on the newly constructed boulevard was adopted by resolution.

Oakland, Cal.—Sealed bids will be received by the Board of Supervisors up to September 30th, for the construction of a water plant for the County Roads leading from Dublin to Pleasanton, and from Dublin to Hayward. Plans and specifications are on file with the clerk.

Dinuba, Cal.—A special election will soon be held in this city, at which time will be submitted the question of incurring a debt for the purpose of acquiring and constructing municipal water works in this city. The estimated cost is $20,400, and the amount of the principal of the indebtedness proposed is to be $20,000. The rate of interest is 5 per cent per annum.

San Rafael, Cal.—The Marin County Water Co. has purchased a reservoir site in Baltimore Canyon. It is located on the high ridge between Coleman, Forbes and Pixley Tracts, and will have an elevation of 300 feet. The company expects to build a reservoir on this site, and have it completed by the first of next year. It will have a capacity of 3,000,000 gallons.

## OIL.

San Francisco.—The Associated Oil Co. has leased the entire seventh floor of the remodeled Wells Fargo & Co. building, on Second and Mission Streets.

Coalinga, Cal.—The California Oil Fields, Ltd., has commenced the building of a town upon the east half of section 27-19-15. Brick foundations are laid for the buildings, and streets platted with the lay of the land. The company has made a contract with Charles Henslick to build seven of the fourteen buildings, and the office building. The labor contract will be about $3,000. None of the buildings will cost less than $1,800. The town will be called "Limited Camp."

Bakersfield, Cal.—The production of oil in the Kern River field during the month of August exceeded all former months. The shipment of oil reached its highest total, 5,018 cars of oil, or 2,540,000 barrels, having been hauled out of the field by the Southern Pacific. The shipment of oil exceeded the production in the field, as a considerable amount of the shipments was drawn from storage. This goes to prove very conclusively that the production of oil does not exceed the demand. The shipment of oil so far this month is keeping up well, and it is possible the September shipment will exceed the August record.

## WATER SUPPLY.

Oakland, Cal.—Acting on a request of the Board of Public Works, the City Council has voted to appoint a special committee of three, to be placed in charge of negotiations directed toward the acquisition by the city of Oakland of a water supply from the Sierra Nevada Mountains. There was no opposition among the councilmen. The committee will be appointed later.

City Engineer Turner is responsible for the bringing forward at this time of the plan to secure a water supply from the Sierra. The communication from the Board of Public Works, of which he is a member, declares that this water supply will be necessary to the city within a few years, if it continues to grow as it is growing now. The suggestion is made that the committee appointed shall act in conjunction with the authorities of San Francisco to secure a water supply that may be used by both cities. Failing in this, Oakland is advised to secure a supply for itself, either through the People's Water Company or independently.

## INCORPORATIONS.

Bakersfield, Cal.—The Wilbert Oil Co. has been incorporated with a capital stock of $25,000 by H. L. Packard, F. G. Munzer, and others.

San Diego, Cal.—Articles of incorporation have been filed by the South Coast Oil Company, with J. R. Berry, F. S. Gruber, and J. E. Wyckoff, of Los Angeles, G. H. Clarke, and J. R. Smith, of San Diego, as directors.

Los Angeles, Cal.—The Pasadena Consolidated Gas Co. has been re-incorporated with an increase of capital stock from $250,000 to $1,000,000. The directors are: W. B. Cline, W. Van Dyke, H. L. Flash, and W. E. Houghton.

Riverside, Cal.—The Santa Ana River Water Development Company, with a capital stock of $300,000, has been incorporated by G. W. Sherwood and L. P. Drake, of Fullerton; A. N. Saxton and Geo. Dierker, of Orange, and M. Nisser, of Santa Ana. Place of business is Carson City, Nev.

## ELECTRIC RAILROADS.

Gresham, Ore.—The Mount Hood Electric Railway has purchased right-of-way, and will commence grading a line to this city at once.

San Francisco—R. A. Bray, A. W. Maginia, Curtis Hillyer, F. C. Van Deinse, M. L. Washburne, H. C. Mack, and Charles Elsey, have incorporated the Northern Electric Railway Company, with a capital stock of $25,000,000.

Vancouver, Wash.—Work on the street railway system will soon begin again, the work having stopped a short time ago because of the failure of a Portland bank, whose president was largely interested in the Vancouver Railway. Local capitalists have secured control of the enterprise, and will push the construction work.

Sandpoint, Ida.—A franchise has been asked for by a few of Sandpoint's business men, for the construction of an electric railway, running from Welty, where the Big Rover Lumber Company's mill is located, to Kootenai, passing through Sandpoint and Ponderay. The latter place, where the Panhandle Smelter is located, being nearly two miles from Sandpoint, would then be in close touch with the city, as well as the other points mentioned.

Livingston, Mont.—Dan Yancey, who has resigned his position as assistant attorney-general, will open a law office in the Garnier-Miles Building. Mr. Yancey says that he, and others with him, expect to build an electric road up Shields River. It is not settled at this time how far the line will be built, but in case White Sulphur Springs will give a bonus, and a right-of-way can be secured free over the entire line, it is likely the new road will cross the Milwaukee Railroad near Dorsey, and thence to the Springs.

North Yakima, Wash.—Two street cars have already been purchased by the Yakima Valley Transportation Company, which indicates that the company intends to go ahead with its work. The cars were secured from the Tacoma Railway & Power Company, by George S. Rankin, vice-president of the local company. The transportation company has formally notified the City Council that it will not accept the amended franchise, and will proceed with its work under the original franchise, which provides that three miles of track shall be laid within the city by the first of next year.

Spokane, Wash.—The Spokane Traction Company will build a car line to the Spokane Interstate Fair Grounds, and enter into active competition this year for the passenger traffice to and from the big Fair. Announcement was made at the Terminal Building that the East Broadway line of the traction company will be extended to the main entrance of the Fair Grounds. The East Broadway line now runs from Olive Avenue into Madelia Street, passing under the subway on that thoroughfare. A new line will be built from Madelia Street through Bradley Avenue, a distance of about six blocks, to the entrance to the Fair grounds.

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